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ABSTRACT

The purpose of this report is to develop a strategy for improving both national and state forecasts of future attrition rates. A theory of teacher attrition is developed that attempts to account for the disparate reasons for attrition, and to explain the patterns of attrition unique to each life cycle and career stage. Existing literature on teacher attrition and present attrition patterns from several states are selectively reviewed for the purpose of testing hypotheses derived from the theory of teacher attrition. Existing data available to support improved attrition models are reviewed, and recommendations are made for better use of these data. Finally, sampling and data collection strategies are identified that will improve the value of data collected in a future national survey. (JD)

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Teacher Attrition

The Uphill Climb To Staff the Nation's Schools

David W. Grissmer, Sheila Nataraj Kirby

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The Uphill Climb To Staff the Nation's Schools

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Center for the Study of
the Teaching Profession

FOREWORD

A great deal of uncertainty surrounds the issue of whether our nation is about to experience a severe shortage of teachers. Will there be a shortage? Or will the supply of teachers be sufficient to meet demand? Will the availability of jobs in teaching cause more college students to major in education? Uncertainty exists for several reasons. First, teacher demand and supply are difficult to predict because human behavior is difficult to predict accurately. Second, data on teacher demand and supply trends are fragmented, and available data have been insufficiently analyzed.

This report draws together available evidence on teacher attrition—the largest single determinant of the demand for new teachers. By understanding attrition trends, policymakers can better anticipate the prospects they face.

The results of this analysis are not cause for comfort. Teacher attrition—currently near its lowest levels in 25 years—will begin to rise. In recent years, attrition has ranged from about 6 to about 9 percent. In the 1960s, attrition ranged as high as 10 to 17 percent. Although attrition rates may not return to those levels, they are expected to rise for the next ten years.

The explanation offered by the report is straightforward. The probability that a particular teacher will leave a school district follows a U-shaped curve: It is as high as 20 to 25 percent for a beginning teacher, a very low level of 1 to 5 percent for a mid-career teacher, and 20 to 25 percent again for a teacher approaching retirement eligibility. Obviously, a school district's or state's attrition rate is highly sensitive to the age distribution of its teaching force. The current teaching force has an unusually high percentage of teachers in mid career. As teachers age, more will become eligible for retirement and attrition will increase. Moreover, as more young teachers are hired as replacements and to meet increased demand, the attrition rate will be further boosted by the higher probability of attrition by beginning teachers.

Of course, attrition is but one cause of increasing teacher demand. Demand will also grow as the result of increasing enrollments, declining class sizes, and the introduction of new programs. To avert a shortage, the supply of new teachers must increase or the demand for teachers must be tempered.

A critical component in teacher supply is the number of individuals majoring in education in college. In 1986, 7.3 percent of freshmen entering college stated an intention to pursue a career in elementary or secondary education. This represents an increase from 4.7 percent in 1982 but it is still only one-third of the 21.7 percent who intended to pursue such careers in 1966 (Astin et al., 1987).

Although interest in teaching may continue to increase because of the availability of jobs, teaching must be made more attractive to ensure that a sufficient supply of talented young people enter teaching. Many states and school districts are making teachers' salaries more competitive and are considering the professionalization of teaching and improving the conditions of work. Others are easing entry to teaching by offering scholarships and forgivable loans to prospective teachers. Still others are easing entry to teaching by eliminating teacher education and certification requirements and hiring personnel who do not meet existing state and local standards.

The demand for teachers and the supply of teachers obviously interact. The longer teachers remain in the teaching force, the lower the attrition rate and the lower the demand. Measures that make teaching a satisfying life-long career should reduce attrition. Many believe that the professionalization of teaching—with increased teacher influence inside and outside the classroom—will have this effect. Reducing attrition of beginning teachers will have a major effect on the demand for new teachers. A district that currently loses 50 percent of its beginning teachers within the first three to five years, as many do, will have a substantially reduced replacement task if it can cut such losses to 25 percent. Intern-mentor programs and other forms of supervised induction are promising developments that help new teachers adjust to the demanding job of teaching. At the other end of the experience spectrum are measures that would create incentives to defer retirement. Many states and districts, with the mindset produced by a decade of being unable to "bring in new blood," have established policies to promote early retirement. No doubt, faced with teacher shortages, they will also consider establishing policies to encourage some teachers to remain to normal retirement age.

Rising teacher attrition rates complicate projections of teacher supply and demand. Too often states project teacher demand simplistically—without taking attrition dynamics into account. Such projections will inevitably be inaccurate. Several states have data bases with which improved predictions can be made. However, analysis of these data has not received priority either at the state or national level. In the short run these data provide the best opportunity for improved attrition estimates. In the longer run a National Survey of Teachers sponsored by U.S. Department of Education's Center for Statistics will provide longitudinal data on teachers who leave and teachers who stay. Analysis of data from this survey, in conjunction with state data, will significantly increase our ability to accurately forecast teacher attrition and teacher demand.

Arthur E. Wise

Center for the Study of
the Teaching Profession

PREFACE

This report should be of interest to audiences at both national and state levels who are interested in the broad question of teacher supply and demand. It should be of particular interest to individuals and agencies attempting to model and project teacher supply and demand. Teacher attrition is the largest and, until now, most neglected component of teacher demand. Most new teachers are hired to replace leaving teachers rather than to meet the needs of expanding enrollments or new programs. The report makes clear that without a better understanding of the dynamics of teacher attrition, forecasts of future shortages or surpluses are likely to be considerably in error.

The research presented in this report was supported in part by the Center for Statistics, U.S. Department of Education. Additional support was provided by RAND's Center for the Study of the Teaching Profession.

SUMMARY

Forecasts of teacher attrition rates are a critical component in attempts by school districts, states, and the nation to determine how many new teachers will be needed in coming years. Estimates of the demand for new teachers—combined with estimates of the likely supply of teachers—form the basis for assessing potential teacher surpluses or shortages. These assessments of the potential surplus or shortage of teachers partially form the basis for policies concerning teacher salaries and play an important informational role in the teacher labor market to attract college students and others considering teaching. Inaccurate forecasts can lead to poor occupational choices and training investment decisions and can also lead to inefficiency in setting teacher salary levels.

Obtaining accurate forecasts of the number of new teachers to be hired requires the accurate prediction of three components of teacher demand: enrollments, student/teacher ratios, and teacher attrition. Of these three, teacher attrition is the most important and most sensitive in determining the demand for new teachers. However, it is also the most difficult to estimate.

The objective of this report is to develop a strategy for improving both national and state forecasts of future teacher attrition rates. We first develop a theory of teacher attrition that attempts to account for the disparate reasons for attrition and to explain the patterns of attrition unique to each life cycle and career stage. We then selectively review existing literature on teacher attrition and present attrition patterns from several states that allow us to test hypotheses deriving from our theory. We then review the existing data available to support improved attrition models and make recommendations for better use of these data. Finally, we identify sampling and data collection strategies that will improve the value of data collected in a future national survey of teachers.

REASONS FOR TEACHER ATTRITION

Understanding patterns of teacher attrition requires first that attrition decisions be placed in the context of the career and life cycle of individuals. Only then can the more subtle—but more policy-relevant—influences on attrition, like salary, working conditions, and learning environment, be explored. This is necessary because the

dominant variables that govern teacher attrition patterns are connected to life cycle events or to career patterns that are probably not unique to the teaching profession.

Life cycle events influencing teacher attrition include marriage, migration, birth of children, entry of children into school, and retirement. Career patterns include movement to better teaching jobs, returning to school for advanced degrees, and moving out of teaching into other education-related jobs such as administration or counseling. The life cycle and career pattern of a teacher's spouse can influence attrition in the same way. Spouse movement into a better job often requires a move, which means no longer teaching in a district.

Failure to place teacher attrition decisions in the context of career and life cycle decisions is perhaps the major shortcoming of efforts to improve understanding of teacher attrition. Another major problem in attrition research is the failure to measure and categorize important subgroups of teachers who terminate employment at the school district level. Subgroups that we need to identify include those who leave teaching altogether; those who plan to teach in a different district in the following year; those leaving teaching temporarily; those leaving permanently; those leaving voluntarily; those leaving involuntarily; those leaving who are excellent teachers; and those who are mediocre or unsatisfactory. Failing to distinguish among these important subgroups leaves attrition research fairly impotent in addressing educational policy issues.

Data currently available for studying teacher attrition can give only a sketchy picture of these important subgroups. Reasons for leaving teaching are sometimes given and some inferences can be made concerning whether individuals might return. For instance, many teachers not returning to a district either may teach in another district in the following year or may return to teaching in that district in future years. Approximate estimates made from data showing reasons for leaving show that approximately one-third to two-thirds of teachers leaving a district in 1966, 1971, 1976, and 1981 probably would return to teaching.

The main reason teachers leave district teaching jobs is to teach in other districts; this accounts for between 15 and 40 percent of district attrition. This "interdistrict" mobility is often connected to normal career progression and life cycle events. Departing teachers seek promotion, improved salary, better assignments, and improved teaching conditions; or they may be moving as a result of marriage or a spouse job change.

Teachers who leave teaching jobs temporarily constitute over 15 percent and as high as 40 percent of district attrition. Their reasons for leaving are also often related to career and life cycle events, including raising a family or returning to school. These teachers may also withdraw to try another occupation, later returning to teaching.

The major other career and life cycle events influencing teacher attrition are retirement, illness or death, promotion to administration, or lateral transfer into education-related positions such as counseling, library, or curriculum planning. These usually account for at least 10 and as much as 25 percent of district attrition. Together, interdistrict mobility, temporary withdrawal, retirement, illness and death, and promotion and transfer to other education jobs can account for approximately two-thirds to three-fourths of district attrition.

The remaining approximately one-third to one-fourth of district attrition constitutes primarily teachers who leave permanently to seek other employment outside education. Some of those who leave for outside employment do so involuntarily, either because of poor teaching performance or reductions in force. Thus, one-third to one-fourth represents an upper limit on voluntary teacher attrition to employment outside education.

Although those leaving voluntarily and permanently for outside employment usually constitute less than one-third of teachers leaving a district, the quality of those leaving should be of concern. Some evidence suggests that this group includes teachers with stronger credentials and test scores. This group also may be the group most strongly sensitive to teacher salary and working conditions. So, although representing a smaller proportion of the total district attrition, this group should probably receive a disproportionate share of the research focus. Understanding this group will be especially important if the current efforts to improve the quality of entering teachers are to be successful. Developing successful policies to prevent attrition of these higher quality teachers who enter the profession in the future can depend on present research on this group.

This research can be considerably enhanced with improved data collection at the national level and more comprehensive analysis of existing state data on teachers. Longitudinally collected data at a national level both on teachers who stay and those who leave could close a significant part of the gap in our understanding of teacher attrition. However, several state databases have tracked within-state teachers for up to 20 years, and proper analysis of these data could also significantly enhance our understanding of teacher attrition patterns.

THEORY OF TEACHER ATTRITION

The theory of teacher attrition developed here embeds the patterns of attrition in a career and life cycle context. The timing of marriage, birth of children, geographical migration, and retirement all play important roles in explaining teacher attrition. Normal career progression patterns within the education profession also are important. These include interdistrict mobility caused by seeking higher salaries, better assignments, or working conditions; returning to school for graduate education; and promotion or lateral transfer out of teaching to other education-related jobs. The theory also draws from human capital theory which uses concepts of occupation, location, and firm-specific human capital to explain both intra- and interoccupational movements over a life cycle. Finally, the role of imperfect information in the teacher occupational decision and the school district hiring decision is used to help explain high levels of teacher attrition early in the career.

The major prediction from the theory is that teacher attrition patterns will follow a U-shaped curve over the life cycle. For instance, age-specific attrition probabilities will be high for younger teachers who are early in their career, very low for middle-aged teachers during the mid-career phase, and high again once retirement eligibility is achieved. The theory also predicts that the specific shape of the U curve would be different for men and women because of earlier marriage for women, different migration patterns after marriage, different labor force participation patterns arising from pregnancy and childrearing responsibilities, and different earning opportunities outside education.

Higher rates of attrition during the first 10 years of teaching are not the result of a single factor but tend to result from the confluence of several different factors. Interdistrict and interstate mobility of teachers is high for younger teachers, because they often accept first teaching jobs paying lower salaries, with bad teaching assignments, and in less desirable locations, but then seek and find better paying teaching jobs, with better assignments, and in more desirable locations. Once there many will stay throughout their careers.

Individuals may also leave early in their careers because of a mismatch between original expectations and actual experience as teachers, arising because individuals enter employment commitments with incomplete information. If more complete information gained from teaching experience reveals a mismatch, transfers to other occupations or to nonteaching jobs within education are generally easier at this early phase of the career, as salaries and debt obligations are lower, and investment in occupation- and location-specific human capital is not as high as at later career points.

Conflicts are also more likely to arise early in the career between the demands of teaching and family formation, and many teachers leave temporarily to have families. Returns to school to obtain graduate credentials also occur early in careers because forgone earnings are lower and the payback period for this investment will be longer. Further, moves requiring separation from a teaching job are also more likely at younger ages, perhaps triggered by marriage or spouse employment changes.

Involuntary termination is also more likely at younger ages. School districts also make hiring commitments with incomplete information about newly hired teachers. As they gain information about teaching skills, reliability, and commitment they also may terminate the teaching contract after a year or two. Young teachers are sometimes hired with temporary certification, and failure to achieve permanent certificates can be a cause of early leaving. Finally, reductions in force fall more heavily on teachers with less experience.

Mid-career attrition (occurring roughly after 10–25 years of teaching experience) is much lower than early-career attrition primarily because of the "absence" of most of the factors causing earlier attrition, the accumulation of occupation- and location-specific human capital, and a self-selection process whereby those staying have a higher taste for teaching.

Several factors that lower attrition change between early and mid career. The uncertainties felt by the teacher about teaching and by the school district about the teacher caused by imperfect information disappear. As individuals move into more preferred teaching jobs, the motivation and opportunity for even better teaching positions begin to disappear. The likelihood of career interruptions or geographical moves resulting from marriage, childbirth and raising of children, and returns to school declines. Finally, seniority provides increasing protection against termination resulting from reductions in force.

Other barriers to leaving begin to arise during mid career. It is harder then for teachers to find alternative jobs with matching salaries, because their salaries have risen and they lack the occupation-specific human capital that could command equivalent salaries in other occupations. They are also less likely to be able to accept lower entry-level salaries in other occupations—or to return to school for retraining—because of family responsibilities and debt obligations.

Two institutional factors also act to deter mid-career departure. The first is the possibility of substantial loss of pension benefits, which cannot be transferred to other states or school districts. This lack of portability of pension benefits is a significant barrier to both attrition outside teaching as well as interdistrict mobility. The second barrier is preferential local hiring rules which can deter teachers from entering a new district after a certain age. Thus, intradistrict transfer as opposed to interdistrict transfer is much more common during mid career.

Late-career attrition is dominated by the structure of the relevant retirement system. Most retirement systems have both age and experience requirements that must be met before the teacher is eligible for retirement. Typically, early retirement is possible at age 55 at lower benefit levels than retirement at 65. Attrition rates increase when teachers reach the minimum requirements for eligibility and usually increase through mandatory retirement age. Certain age groups such as 62 and 65 can have markedly higher attrition both because of system rules as well as Social Security eligibility.

PATTERNS OF ATTRITION FROM STATE DATA

Cross-sectional data from two states confirm this life cycle pattern for different types and levels of teachers. The data show that annual attrition rates at the state level for young, inexperienced teachers can reach 20 to 25 percent annually, but they decline steeply with age or years of experience until a mid-career plateau is reached. The rates then rise again with retirement eligibility. During mid career, age-specific attrition rates usually dip to between 1 to 5 percent. At retirement eligibility the age-specific attrition rates again rise rapidly and can again reach levels of 20 to 25 percent. This pattern holds for both male and female teachers and for elementary and different types of secondary teachers.

In addition to cross-sectional data that tend to support a U-shaped attrition, available times-series data from a few states also tend to support these life cycle patterns. The major pattern that emerges is somewhat irregular but shows strongly declining teacher attrition rates from the mid 60s to the early 80s. The major factors that seem to explain these declining attrition patterns over the last 25 years appear to be the composition of the teaching force, the presence of reductions in force, and the tightness of the teacher labor market.

In the 1960s and early 1970s there was a strong demand for new teachers, which shaped primarily a younger, less experienced teacher force, leading to relatively high attrition rates (10–15 percent). As the demand for teachers declined rapidly with declining enrollments in the 70s and early 80s, fewer younger teachers were hired, and reductions in force occurred that fell disproportionately on younger teachers. These factors shaped primarily a middle-aged mid-career teaching force, and once reductions in force were complete, attrition rates fell to the 4–8 percent range in the 80s. Lower attrition resulting from a different age composition was reinforced by the weak demand for new teachers in the early 80s which made teachers reluctant to migrate or to leave the profession because of the uncertainty of returning.

Evidence from our available state time-series data suggests that at present attrition rates are near their lowest levels in the last 25 years. However, several factors will begin to affect these rates over the next 15 years. Mid-career teachers will become eligible for retirement. Retirement rates will slowly increase during the next five years and then more rapidly during the next 10 years. More younger, inexperienced teachers will be hired in response to the increasing enrollments of the baby boomlet and to replace retiring teachers. Expanding enrollments will also present more teaching and administrative positions allowing more internal mobility and promotion. Teachers will find it easier to leave for periods and remain confident of reentering. Finally, success at achieving a higher standard of quality among entering teachers may also raise attrition rates because these teachers usually have more and better outside opportunities.

Although several factors will tend to push attrition higher, policy changes can have an important influence. Developing policies aimed at retaining younger teachers who perform well will be important. The number of young teachers will be increasing, and they usually make career decisions during the first five years of teaching. Policies that carry more of these teachers into mid career could have high payoff. If desirable, more years of teaching could also be obtained from retirement eligible teachers if policy incentives are given for later retirement.

Nationally, this upward pressure on attrition will be first felt at the elementary school level as increased enrollments begin there around 1986. Besides increased enrollments, the demand for elementary school teachers is rising because many states are implementing significantly lower class sizes at lower elementary levels. On the other hand, high school teachers should continue to have relatively low and stable attrition rates as their enrollments continue to decline until around 1993. However, assessment at the high school level requires detailed analysis for each subject area. It will be critical for supply/demand models to account for the magnitude and timing of these changes in attrition to assess teacher shortages accurately.

These patterns of attrition can be markedly different for individual states. Teacher salary levels, certification standards, and working conditions peculiar to states also will place unique imprints on attrition patterns. For these reasons and others cited in the report, we emphasize the importance of state data in analysis of both attrition factors and other supply and demand factors.

NEEDED DATA DEVELOPMENT

Current forecasts of teacher attrition are weak compared to forecasts of enrollment and pupil/teacher ratios, mainly because of inadequate and unanalyzed data. Much more effort is expended at the district, state, and federal levels in gathering and analyzing data on enrollments and student/teacher ratios than on attrition. Partly this is because information on enrollment and pupil/teacher ratios is used in a wide variety of applications, whereas the need for teacher attrition information is more specialized to supply/demand concerns. It is also more difficult to routinely compile accurate teacher attrition data. It requires an information system that tracks teachers longitudinally so that one can determine at two points in time who is teaching and who is leaving.

Nationally, such an information system for teachers does not exist, so good historical estimates of national teacher attrition do not currently exist. It may be possible to use national data collected for other purposes to obtain some crude national estimates of teacher attrition. These data include the current population surveys, the Social Security Longitudinal file, and census data. However, use of these kinds of data inevitably results in much poorer estimates than would be produced by an information system directed specifically toward teacher attrition. This is because sample sizes of teachers in such data collection are small, problems exist in precisely defining a teacher, and many of the independent variables needed to define multiple definitions of attrition and to develop models of attrition are not collected.

The states vary markedly in their capacity to provide attrition information. Some states can provide consistent and accurate historical attrition information for up to 25 years. Such states typically have computerized information systems that contain an annual census listing of teachers. These teacher files contain individual records usually organized by Social Security number for each teacher together with information on demographics, teaching assignment, and salary. Such files form the ideal basis for generating and analyzing attrition rates.

Approximately one-third to one-half of the states routinely maintain such teacher census files for purposes of either education planning or pensions. These files typically extend back five or more years with a few states having files for 15 or more years. However, few of the states have fully exploited these files to produce and analyze attrition estimates or to use them effectively in making teacher supply and demand estimates. As such, they represent an untapped state and national resource for improving teacher attrition and supply and demand estimates.

One approach to tapping this resource would be to centralize *selective* state teacher personnel and certification files to form a research database that could support excellent time-series and cross-sectional analyses of attrition. Even though data may be available from fewer than one-half of the states, there would be a much larger coverage of the teaching population (as much as 75 percent), since it is primarily larger states that have the better data. Analysis of these data across several states would identify underlying factors and trends that would also allow inferences to be made about missing states. However, the quality of these data should first be assessed before large investments are made in centralization.

A different, but complementary approach already under way to improve attrition data is a large national survey of teachers with a longitudinal follow-up. National data that sample teachers and longitudinally follow both leaving and staying teachers can provide base estimates of attrition using various definitions and for many different teacher categories. The key advantages of this type of survey in estimating attrition is that it can collect nationally representative data, can track teachers across state lines and determine who leaves or who stays in teaching, can support multiple definitions of attrition, and can collect a wide variety of independent variables important to attrition analysis. Proper analysis of these data has the potential to yield models that estimate attrition probabilities as a function of teacher characteristics, teacher locations and types of schools, teacher salaries and working conditions, and some characteristics of the local economy. Better forecasting models can result from this analysis.

State record data can complement national survey data, which alone will leave several gaps in studying attrition. First, the national survey will always have limited sample size for studying interesting subgroups of teachers because of the expense of enlarging the survey sample. State data, however, contain a complete census of teachers within a state, so there would be a large enough sample size to study, for instance, young science teachers who are female. Second, nonresponse bias could be a potential analysis problem with survey data especially for leaving teachers. Leaving teachers may respond at different rates than those staying, leading to potential bias in the analysis of results. State data do not have this problem. Third, the national survey will provide no time-series data but only cross-sectional data on attrition in the year of the survey. This will limit its applicability in making future forecasts. Fortunately, some of these problems can be avoided through complementary use of existing state data on teachers.

Analysis of these state data will also have limitations. Generally one cannot tell the status of leaving teachers in the next year, nor are reasons for leaving generally collected (although at least two states do collect these data). Also, since one is dependent on existing state data, a nationally representative sample cannot be achieved with known accuracy. Finally, the set of variables to include in attrition models will be limited. The list will generally include demographic and experience variables and some characteristics of the county in which a teacher works. National surveys can collect a much richer set of variables for analysis. These include school-specific variables, measures of working conditions, family status variables, and other attitudinal measures.

NEEDED RESEARCH

Research on attrition can be characterized generally as sporadic and piecemeal, with the exception of a series of reports done in the early 1970s (Greenberg and McCall, 1973, 1974; and Keeler, 1973) and the work of Murnane (1981a, 1981b, 1984). There has been no sustained effort with the necessary resources and long-term commitment that makes possible pace-setting and rapid research progress. This failure has led to a diversity of definitions and methods of analysis, many small sample size studies, and virtually no continuing efforts to analyze attrition consistently over time in any locality. Results of such a diversity of studies are thus difficult to interpret and there exists little sense of learning or building from previous studies.

Part of the neglect of teacher attrition research has simply been the lack of clear need because of the recent oversupply of teachers. However, this fragmentation of effort also exists because of the state-federal division of responsibilities in education. Many states have excellent data on which to support attrition research, but limited research resources and expertise to carry out such research. On the other hand, the federal government has a clear role to carry out this type of research—especially, because there would be large economies of scale in carrying out such research—but has not either generated or collected the data to support such research.

There are two distinct lines of research that new data collection should support. The first is developing improved attrition forecasts for use in teacher supply and demand models. Attrition-related analysis needs to provide two important contributions to teacher supply and demand models. The first is forecasts of teacher attrition rates given a starting composition of the teacher labor force and various future labor force and educational policy scenarios. The second is estimates of the number of returning teachers from the pool of those who have separated. The latter is an important supply component of the so-called reserve pool.

The second line of attrition research is directed toward improving the quality and efficiency of the teaching workforce. Attempting to improve the quality of the teacher workforce during the approaching period of expansion will be difficult, because of the natural tendency for declines in quality and productivity during periods of expansion. Expanding the workforce means hiring more inexperienced and less productive individuals. Pressure also exists to retain marginal teachers and to relax certification requirements to meet the higher demand. Both of these tendencies also lower workforce quality. Finally, gains in productivity from the current largely mid-career workforce may be small if teachers follow normal job learning curves. These learning curves tend to flatten during mid-career.

To counter these tendencies, we will need policies aimed at improving the quality and productivity of entering teachers, shortening the learning curve once in the teaching position, and evaluating and retaining better teachers. Research on teacher attrition taking account of quality and teacher characteristics is an important part of formulating these policies directed at teacher labor force improvements.

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I. INTRODUCTION

Recent publications have described a potential shortage of teachers during the period 1985-2000 (Darling-Hammond, 1984; and NCES, 1985b). The most important cause cited is the upturn in the number of children born during the late 1970s and early 1980s—the so-called baby boomlet. Other trends that have been cited in support of this argument are the higher predicted level of teacher retirements over the next 15 years, the declining number of college students majoring in education since the 1970s, a trend toward more stringent teacher certification standards in some states, and the continuing move toward smaller class sizes.

However, other trends apparently run counter to these and one recent report takes a more optimistic view (Hecker, 1986). High school and junior high enrollment will still be decreasing for several years. The female, college educated, labor pool between ages 30-45—a pool that provides many reentering teachers—will be increasing rapidly in this period. In addition, the number of individuals choosing education as a major and the number willing to teach has historically evidenced strong—but delayed—responsiveness to demand conditions. Teacher salaries also appear to be moving upward—another sign of market responsiveness. In addition, some states appear to be relaxing certification standards by allowing college graduates with little or no prior preparation in education to teach. This is particularly true for certain subject areas such as science and mathematics. These opposing factors create considerable uncertainty regarding the likelihood and magnitude of a teacher shortage.

It is evident, however, that the teacher labor market will undergo some structural changes during the coming years. This has focused attention on the status of teacher supply and demand models and the ability to gauge accurately the overall effects of these changes. Assessments of such models have generally painted a bleak picture of our present ability to accurately estimate supply and demand, given the inadequacy of available data, the limited research base from which key parameters can be estimated, the inadequacy of approaches used in designing models integrating supply and demand, and the inherently complex nature of the teacher labor market itself (Cavin, 1986; Popkin and Atrostic, 1986; and Barro 1986).

Several simultaneous efforts are needed to improve teacher supply/demand models. These efforts include building a stronger national database on teachers, more intensive use of existing state databases on teachers, better focused research efforts on estimating key parameters critical to accurate supply/demand modeling, and design of properly disaggregated and integrated supply/demand models. This report focuses on improving our estimates and forecasts of one of the critical parameters in such models, namely, teacher attrition rates.

Teacher attrition rates are important because they are the major component in determining the annual demand for new teachers. Most new teachers are hired to replace leaving teachers rather than to meet the needs of expanding enrollments, or smaller class sizes, or new programs. The contribution of each of these components to new teacher demand can be best illustrated with a simple example.

Assume first that class size, enrollments, and programs stay constant. Then new teachers would be required only to replace leaving teachers. Currently used Center for Education Statistics estimates place attrition at approximately 6 percent of the teaching force, thus annual demand for new teachers would also be 6 percent of the teaching force.

If enrollments increase, even more teachers will be needed. National projections show that cohort enrollments can be expected to increase nationally at no more than 2.5 percent per year for several years.[1] Assuming that class sizes stay constant and that annual enrollment increases 2.5 percent, total demand for new teachers would increase to 8.5 percent (6.0 + 2.5) of the teaching force.

More new teachers will be needed above those required as replacements and to meet expanding enrollments if class sizes also decrease. Class sizes have historically changed very slowly, declining by less than 0.5 percent annually. If we assume the same rate of annual decline for the future, new teacher demand would be 9.0 percent (6.0 + 2.5 + 0.5). These relative magnitudes should suffice to show that teacher attrition is the most important component of national teacher demand, even during periods of rapidly growing enrollment.

The fact that attrition is the most important component of new teacher demand is not, by itself, sufficient to justify efforts to improve forecasts of attrition. If historical attrition estimates were highly accurate and this trend were expected to continue into the future, then little additional effort would be justified. Unfortunately, of the three components of new teacher demand, teacher attrition has the most uncertain historical estimates and is expected to change markedly in future years. Thus, it is not only the largest but also the most uncertain and the most difficult to model.

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[1] Individual states and localities may, of course, experience a much larger or smaller rate of increase, so the contribution to new teacher demand in these areas would be proportionately higher or lower.

Forecasting enrollments and class sizes is easier than predicting attrition, because better historical data are available for these two components and the factors producing changes in them are better understood. Enrollments change slowly and these changes can be predicted more or less accurately from historical enrollment data combined with migration and fertility trends. Classroom sizes also change slowly in response to budget pressures, changes in enrollments, or educational policy. Recent evidence suggests that class sizes increase when enrollment increases and decrease when enrollment decreases (Cavin, Murnane, and Brown, 1985). These factors can generally be predicted for the short term, making class size estimates fairly accurate. Further, the historical data required to make enrollment and class size estimates are usually available from local districts, states, the Census Bureau, and the National Center for Education Statistics. However, the data to make reliable estimates of teacher attrition are not collected at the national level. Indeed, NCES projections have for several years used a mid-range 6 percent teacher attrition factor in their projections of teacher demand (NCES, 1985a). This estimate dates back to data collected in 1969.

Although states have much better data with which to estimate attrition, they rarely take full advantage of the data available to develop dynamic models of teacher attrition. Instead, they tend to project constant attrition rates generally based on previous years' rates. These techniques fail to recognize the dynamic nature of teacher attrition and the underlying factors that will cause teacher attrition to increase in future years.

Teacher attrition levels will vary over time with variations in the age, experience, and demographic composition of the teaching force, employment opportunities in other related labor markets, the availability of other opportunities within the teaching profession itself, the teaching environment, and specific personnel policies including teacher salaries and the structure of teacher retirement systems. Failure to account for these changes may lead to a serious under- or overestimate of potential teacher shortages.

At present, attrition rates appear to be at or near their lowest level in 25 years. We can almost certainly expect attrition rates to increase in future years as the demand for new teachers rises and an increasing proportion of teachers reach retirement. Rising demand will have two effects. First it will increase the proportion of younger, more attrition-prone teachers in the pool. Second, it may encourage teachers to move more frequently between districts and states to improve their teaching salaries and conditions. Accounting for these effects will be critical in developing accurate supply/demand models.

These improved estimates would not only improve projections of teacher demand nationally but would be critical in determining where shortages would be most severe. Evidence suggests a good deal of variation among states and within states in the structure and workings of their teacher labor markets. Improved teacher attrition models can help determine attrition patterns across states and districts and can help identify potential shortage areas.

Better attrition models are also needed to help explain why teachers leave and which types of teachers are peculiarly at risk, not merely the magnitude of the problem. This is essential if we are to design or evaluate policies aimed at improving the quality of the teaching force. It seems possible, for instance, to use certain state databases to track teachers from the time of entry and to use certain measures of teacher quality to estimate teacher attrition patterns for teachers of different quality.

A successful model of teacher attrition should be able to attach attrition probabilities to individual teachers on the basis of their characteristics, their teaching specialties, and the characteristics and policies of the school, district, and state in which they teach. Such models can be developed using empirical data from states and districts that record teacher characteristics and teaching history. These data are generally available at the state level but have not been used to develop such estimates.

Such models need a theoretical framework to guide the selection of variables and the specification of the model structure. In this report we develop a life cycle theory of teacher attrition that attempts to account for both voluntary and involuntary attrition. Because teachers leave for a variety of reasons—other jobs, marriage and childrearing, leisure pursuits, and additional schooling—the theory of teacher attrition needs to consider the effects of imperfect information during job search and to draw from economic theories of human capital (Becker, 1964; Mincer, 1977) and occupational choice, theories of family formation and women's labor market participation, theories of individual migration, and recently developed theories of the timing of retirement decisions. This report makes an initial attempt to develop such a theory and to derive testable hypotheses. We then use recent cross-sectional attrition data from two jurisdictions and time-series evidence from four states to see if attrition patterns are consistent with these hypotheses. Finally, we address the data requirements and analysis necessary to improve and extend estimates of teacher attrition. We discuss current gaps in the data at both national and state levels and recommend a strategy for developing better attrition estimates.

The next section presents a life cycle theory of teacher attrition. Section III reviews the extant empirical literature and Sec. IV reports attrition trends for teachers from two states. Section V discusses the data needed to estimate models of teacher attrition and contrasts the merits of the national survey of teachers and existing state data for improving attrition estimates.

II. A THEORY OF TEACHER ATTRITION

The original commitment between a teacher and the school district regarding a teaching position is predicated on prevailing information and circumstances. The key to understanding teacher attrition is to recognize that a change has occurred that causes a reversal of the original decision. What does the individual or the school gain from the decision to terminate? Reasons for voluntary attrition could include higher income from alternative employment, better working conditions elsewhere, more leisure, or improved family welfare (better care of home and family). Involuntary termination of a teacher by a school district could be for reasons of needing to lower costs or wishing to improve average teacher quality. In either case, it is important to realize that some perceived gain is the reason for the separation. As a consequence, a theory of teacher attrition must first recognize that voluntary attrition is fundamentally different from involuntary attrition because the gains accrue to different parties.

Involuntary attrition is usually brought about by the school district, perhaps as part of a general reduction in force because of lower enrollments, in attempts to lower costs, as a result of substandard teacher performance or credentials, because of mandatory retirement rules, or through illness or death. Thus, theories of involuntary teacher attrition need to consider political and bureaucratic decisionmaking by local school districts and teacher unions, certification and recertification procedures, and theories of teacher demand. The latter are extremely important, since school boards often respond to reduced demand by reducing the workforce. Finally, estimates of attrition resulting from illness and death can be based on simple illness and mortality incidence.

Teachers leave voluntarily for a variety of reasons closely linked to life cycle and career stages—characteristics of teachers, working conditions, teaching salaries and benefit levels, and economic conditions both within and outside the teacher labor market. A theory of voluntary teacher attrition thus must draw together theoretical strands from several different fields of study. Teachers may leave for economic reasons, which can be best explained using human capital theories of occupational choice. They may leave to start and raise families or because their families move. These would require us to consider theories of household migration, fertility, and labor force participation of married women with dependents. Finally, teachers may be heavily influenced by the structure of the teacher retirement system, which exerts a strong hold on teachers during mid career and strongly affects the timing of the decision to leave. Recently developed theories of the influence of retirement system structure on retention and attrition are needed to explain mid-career and late-career attrition.

The theory we present here draws together these various strands for the first time in the literature. It encompasses attrition over the entire teaching life cycle and attempts to include the role of imperfect information at entry as an important determinant in teacher attrition. Although it is an initial attempt at developing a cohesive and more comprehensive theory of attrition, we feel that it represents an important advance over previous work. Before presenting the theory, we need to delineate what constitutes attrition.

DEFINITIONS OF TEACHER ATTRITION

Teacher attrition is a deceptively simple concept that does not lend itself to a precise, empirical definition. However, without precise and consistent definitions, attrition comparisons over time among different types of teachers, among districts, and among states become impossible. Such comparisons are important if we are to understand the factors underlying higher or lower attrition.

It is important to recognize that there is no *single* appropriate definition of teacher attrition. Indeed, one cannot define teacher attrition until one defines the policy or research context in which a particular definition will be used.

Different policy contexts call for different definitions. Is the context local, state, or national policy? Is the policy concerned with hiring sufficient teachers to meet annual requirements, setting salary levels, or developing policies that attempt to lower attrition?

From a national viewpoint, local attrition that leads to teaching in another school or district is less disturbing than attrition to other occupations. So national policymakers need a definition of attrition that separates those leaving the profession from those who move across districts or states. Only nationally collected data that can track teachers across state lines can accurately measure and identify these groups.

At the state and local level, attrition out of a state or district is of concern, since these leaving teachers need replacement. To the local or state administrator, the fact that a teacher continues teaching outside the state or district provides little comfort.

At a district or state level, different administrative and policy functions will also need different attrition definitions. As an example, one definition might be useful to the personnel administrator responsible for replacement, and another definition to administrators responsible for salary recommendations.

From the standpoint of a personnel administrator who must set hiring goals to meet annual personnel requirements in a local school district, attrition is most usefully defined as encompassing teachers who taught in the district in one year but not in that district in a similar position in the following year. Those teachers must be replaced. In determining the number of teachers to be replaced year to year, an attrition rate based simply on the teaching status of all teachers in the district one year later would be useful.

Several complications arise even at this seemingly simple level. Should a teacher who is promoted into an administrative level be included in the attrition statistics? He/she is not available as a classroom teacher and must be replaced. From the personnel viewpoint the answer is yes.

Another complication arises when hiring to replace teachers. Not only are the right number of teachers needed, but the right *types* of teachers. Thus, attrition rates disaggregated by type of teacher and specialty are crucial. When estimating such rates, one must decide whether to include teachers who, for instance, move from elementary schools to junior high schools. Again, from the personnel viewpoint of replacement, these teachers should be included in both attrition from elementary and additions to junior high.

On the other hand, a salary administrator would be much more concerned with attrition definitions that include attrition by cause and subsequent work status. Voluntary attrition can be separated by the future labor force status of those leaving (see Fig. 2.1). Some voluntary attrition is to other teaching jobs, and whether this is to another school in the district, state, or another state is important. Other voluntary attrition is to another job, to unemployment, or "out of the labor force." This latter category includes those choosing homemaking, school, or other unpaid activities.

Salary increases can deter certain types of attrition (leaving for another occupation) more effectively than others (moving from the district with a spouse, or pregnancy). Thus, trends in attrition by cause of attrition can provide better information concerning the adequacy of teacher salaries.

Another important distinction for the salary administrator is between voluntary and involuntary attrition. Upward trends in voluntary attrition to other occupations is critical to track, so accurate historical data that separate voluntary from involuntary leaving are necessary. It is especially important to identify the frequency and

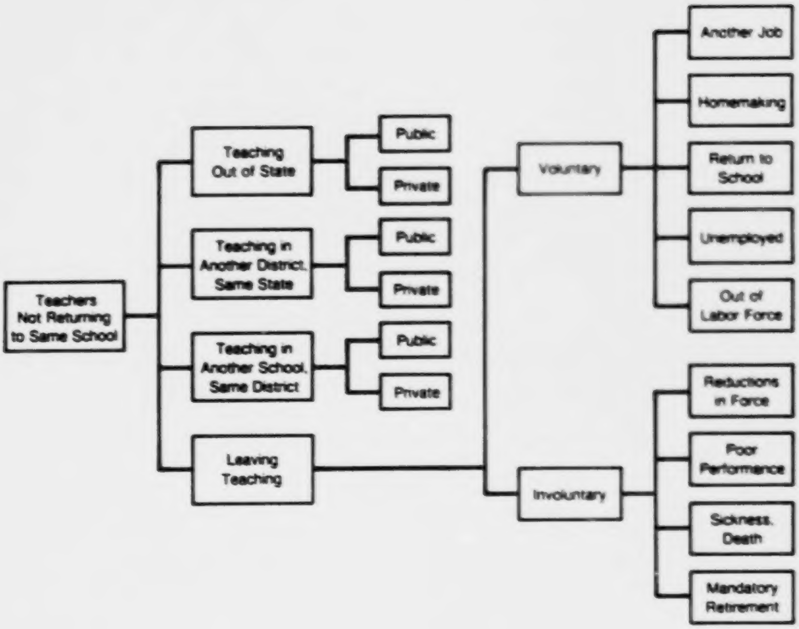
Teachers Not Returning to Same School
Teaching Out of State
Public
Private
Teaching in Another District, Same State
Public
Private
Teaching in Another School, Same District
Public
Private
Leaving Teaching
Voluntary
Another Job
Homemaking
Return to School
Unemployed
Out of Labor Force
Involuntary
Reductions in Force
Poor Performance
Sickness, Death
Mandatory Retirement

Fig. 2.1—Status of leaving teachers

magnitude of involuntary attrition caused by reductions in force during the 1970s and early 1980s. Failing to separate these voluntary and involuntary components would result in inaccurate trends for evaluating salary policy and overestimation of future attrition rates.

The research perspective may require separate, but overlapping, definitions of teacher attrition. Because research seeks behavioral explanations of all types of teacher attrition, definitions that group together similar types of behavior will be needed. Researchers will need to separate attrition by type, in that each type will display a different functional relationship with various attributes of teachers. Attrition to nonteaching occupations certainly will be influenced more by sex and age than attrition to homemaking. Including different attrition types within the same estimation can seriously bias coefficients and result in poor forecasts of future attrition.

Although existing definitions are somewhat unsatisfactory, in this report we will generally use the term attrition to include those who leave teaching for at least one year, and we use the term mobility to indicate teachers who teach in consecutive years but change school districts. We exclude intradistrict teacher moves from our consideration.

VOLUNTARY TEACHER ATTRITION

We need to meld together several branches of literature in developing a theory of voluntary teacher attrition. We will start with a human capital viewpoint.

The Human Capital Theory Approach to Teacher Attrition

The fundamental tenet of the human capital theory of occupational choice is that individuals or households make systematic assessments of the likely net monetary and nonmonetary benefits from different occupations and make systematic decisions throughout their careers to enter, stay, or leave an occupation. The monetary benefits include the stream of likely income resulting from entry into a given profession. The monetary benefits also include likely promotion opportunities as well as the value of benefits: health and life insurance, retirement pensions, and so forth. Benefits must also include aspects of job security—the likelihood of steady employment and periods of unemployment—as well as the opportunity costs of a given occupation. The latter concept refers to the ease of transferring to other occupations either voluntarily or if unemployment occurs.

The nonmonetary benefits within an occupation include working conditions, support of coworkers, compatibility of hours and schedules with family and leisure needs, availability of adequate materials and equipment, and in the teaching profession, such factors as the learning attitude of students.

In addition to the likely stream of income and benefits of each occupation, an important aspect of any occupational decision is the cost of preparing for an occupation or the costs of retraining for another one. These costs must include the costs of schooling (tuition and living expenses while in school) and forgone earnings during schooling and while learning a new occupation. Forgone earnings usually form a significant part of the schooling costs.

In simple terms this theory states that individuals will choose to enter occupations or change occupations to maximize the net returns taking account of both costs of training and stream of benefits—properly discounted.

The theory further posits that as an individual stays in a profession, he/she accumulates occupation-specific human capital which translates into wage premiums that are available as long as the individual works within that occupation. This occupation-specific capital arises from contacts and networks that make jobs and promotions easier, from specialized knowledge within an occupation, and from other factors. This occupation-specific human capital forms a barrier to leaving the occupation, since its absence in another chosen occupation would lead to lower wages.

Occupation-specific human capital works in two ways to deter occupational mobility. Its presence rewards individuals through higher wages for staying, yet its presence in another occupation would mean competing against individuals who have a competitive advantage within that occupation. This typically means that transfer to another occupation often requires salary cuts until similar occupation-specific human capital is acquired. This aspect of human capital theory explains why occupation switching is more prevalent during the early phases of a career as opposed to later.

A third aspect of human capital theory is also important for teaching—human capital that is location-specific. Such location-specific human capital can include home ownership, knowledge about locales, spouse jobs, closeness to friends and families, and knowledge and contacts for summer and alternative employment. Acquiring this location-specific capital in a new location entails time and costs, in addition to the more direct costs of relocation. Those costs help explain why people usually move only if higher wages are offered. It also helps to explains why movement is more likely early in a career rather than in mid career—since more location-specific capital (such as home ownership) is accumulated with age.

A final aspect of human capital is called firm-specific—and in the case of teaching could be associated with particular schools, school districts, or state systems. This capital refers to factors not transferable to other schools or school districts and its presence serves to deter moving from a school or school district.

Instances of firm-specific capital would be institutional/-organizational knowledge of school practices and programs acquired over the years, seniority/status in the system, which is not easily transferable, and so on. One could also hypothesize that the nonmonetary aspects of a job retained for 10 to 15 years would also increase in value: respect of colleagues and administrators, certain forms of autonomy, and privilege.

An extremely important factor that could be described as school-system-specific (district or state) capital is the retirement benefits accruing to teachers. Teacher retirement systems are either local or state-based. In 1980, there were 50 statewide systems and 17 local public employee systems that included teachers (Pease and Victor, 1980; and Victor and Pease, 1980). The local systems are generally associated with large cities or counties. Moves out of the local school system or out of the state would mean that retirement benefits could not be transferred to the new job. Individuals with a number of years of vesting would have a great deal to lose by moving or separating and would be increasingly reluctant to leave. Thus, mid-career and late-career teachers will tend to have extremely low levels of attrition, particularly as the years of vesting and present value of expected retirement benefits increase over time (Viscusi, 1985).

The theory of human capital basically posits that—other things equal—the greater the amount of occupation-specific, location-specific, and firm-specific human capital that accumulates, the lower will be the probability of attrition. An alternative statement of this hypothesis is that higher alternative wages will be required to induce teachers to leave teaching the higher the accumulation of these types of human capital. Generally individuals accumulate these kinds of human capital with years of experience within the profession or at a particular location or a particular school. Thus leaving a profession, location, or specific school is more likely earlier in the career.

The age/experience effect is reinforced by at least two other factors. The first factor is that the costs of preparing for another profession rise with age. This is mainly due to the rising costs of forgone earnings with age, so switching to professions requiring additional schooling becomes less attractive the older one gets. The second factor is that there are fewer working years left for any occupational wage differential to make up for the costs of schooling. Thus individuals usually switch occupations early in careers when salaries are lower and more years of future employment can repay the investment in retraining.

These same factors explain why teachers are more likely to return to school full time early in their careers to obtain advanced education degrees. Salary increases are usually directly associated with advanced degree attainment. Attaining these degrees early reduces the cost of forgone earnings and lengthens the period of higher salary resulting from the degreee

The previous discussion dealt with occupation-specific human capital that deters a change of profession. However, building occupation-specific human capital in teaching can also ease transition into a set of jobs that can be broadly defined as within the education career field.

This "stepping stone" theory of transition out of the classroom involves a set of jobs for which having teaching experience is an asset if not a requirement. Thus, entry into school administration or school psychology and counseling or becoming a college professor of education might require and benefit from elementary or secondary school teaching experience. Teaching experience might also be an asset in entering human service professions, which span a spectrum from social work and psychology to certain types of law.

Thus, for some individuals teaching is a way to get to a more preferred job, and the years of teaching function in several ways to increase the likelihood of getting there. In some cases teaching is a requirement before moving into these jobs. Teaching can also serve as a way to accumulate savings to support graduate or professional school. Teaching can also provide a job while one's preferences for future jobs are sorted through. For these individuals, attrition from teaching is often a planned and sought after transition.

This notion of teaching being a stepping stone may be particularly important in explaining attrition of teachers of higher ability. These teachers would be the most likely to enter administration, go to graduate or professional school, or teach at the college level. The timing of exit from teaching will depend on when opportunities arise for graduate or professional education, or when sufficient savings are available, or when specific job opportunities arise in administration.

There is also a more generic form of human capital which is learned in any occupation and can be transferred to another profession. An example from teaching may include organizational, management, and presentational skills, and specific subject knowledge. This generic human capital usually is useful in some subset of other occupations, and generally defines what occupational transfers are likely. In general, the greater the amount of generic capital as opposed to occupation-specific capital accrued in a job, the more likely changes will occur in jobs or professions. For instance, science and math teachers might be considered to possess a set of skills and knowledge that is more easily transferred to other noneducational, potentially more lucrative jobs.

Although the theory of human capital provides one explanation for the wide variance between early- and mid-career attrition, there is an alternative and supporting explanation. A major limitation of human capital theory is its assumption that an individual has perfect information about both salary, benefits, and nonpecuniary aspects of different occupations and jobs. In reality each calculation involves a great deal of uncertainty. In a world characterized by limited information, such decisions must be made on the basis of very incomplete information.

As a result, occupational choices may be subject to change as new information later becomes available through actual labor market experience. An important reason for attrition can be a change in the information available and values after beginning to teach.

The Role of Uncertainty and Incomplete Information in Teacher Attrition

The process of finding and accepting a job is usually conducted in an environment (like the original occupational choice decision itself) of uncertainty. The worker and the employer both have incomplete knowledge of each other and of other employment alternatives. However, searching for better or more complete information brings with it attendant costs that must be weighed against the benefits provided by the increased information.

We can portray the school and the teacher as entering into the initial teaching contract with limited information about each other because of the costs of further search. Individuals may need to decide on employment before all offers are available. Districts may make offers before all candidates are interviewed. At the time of the offer, however, both parties may consider a specific job to be in their own best interests, based on an assessment of perceived present costs and benefits.[1] For example, for the school, the benefits of an employment offer would include the possibility of having the vacancy filled and the resulting contribution to overall productivity; these would have to be weighed against the risks of not having the vacancy filled and the costs of further search for a replacement candidate. From the individual's point of view, the calculus includes the benefits of accepting employment versus the costs of waiting and searching for a better job and, perhaps, risking not being employed for a period of time.

Early attrition can be explained as resulting from either (a) a reevaluation of the costs and benefits of the current job versus alternatives based on newly acquired information about the current job or (b) a change in the alternative opportunities available at the time the original job decision was made, or (c) some combination of both sets of factors. We can hypothesize that the first type of change involving the accumulation and reevaluation of new information about the current job probably predominates during the first few years of teaching, whereas new job alternatives probably can occur throughout the career.

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[1] For further discussion of costs and benefits in selection decisions, see Wise et al. (1987).

The recent literature in labor market theory attempts to explain quitting behavior in terms of the original uncertainty and imperfect information available at the time of job acceptance. Such models can be classified into two categories according to their characterization of the source of that uncertainty.

The first model of quitting behavior (Lippman and McCall, 1979), a search model, depicts the worker as selecting a job without completely searching all alternative jobs because of high search costs. New information on alternatives after job acceptance leads to a reappraisal of the job match. For instance, a higher wage offer on an alternative job may occur after acceptance of one job. The chances of these alternative offers depend on the intensity of search but will more likely occur in the period after an intense initial job search. Newly hired teachers are thus more susceptible to alternative attractive offers simply because of their recent job search activities.

In addition, information regarding the prospects and attractiveness of relevant alternative occupations is also likely to be received and reevaluated on a continuing basis. Critical parameters in whether alternative offers are sought and whether they will be judged superior are salaries and working conditions. This will be particularly true for individuals with training and skills that are more easily transferred to other occupations or are particularly valued in general (for example, degrees in mathematics and sciences are easily fungible across sectors and probably better rewarded, at least in a monetary sense, in other sectors). Alternative offers may also be more likely in times of economic growth and declining unemployment than during times of economic stagnation and rising unemployment.

The second model, based on Nelson's (1970) approach to consumer behavior in product markets, assumes the existence of unobservable characteristics of a job that can be learned only through experience on the job. As Pencavel (1972) states, "the taking on of a job for a trial period may be the optimum method for an individual to discover whether that employment suits him."

In these experience models, then, jobs have two classes of attributes: inspection (or search) characteristics, which can be observed directly or without actually experiencing the job, and specific (or experience) characteristics, which become evident only through actual experience. The acceptance of any job is conditional; if the jobholder finds the value of the experience attribute (about which he was imperfectly informed) below some critical level, he will quit.

These models can be easily extended to include separations initiated by the employer (involuntary attrition as a result of performance), by positing two types of employee attributes: screening attributes, which can be observed by the employer before employment (say during interviews, certification procedures, or competency tests), and performance attributes, observed by the employer only after the individual works on the job. The attrition process can then be viewed as the consequence of rational decisionmaking in which belated information regarding the various experience attributes of the job by the teacher and the performance attributes of the employee by the employer is received and reevaluated by both. It is entirely possible that the experience attributes of a job may provide considerable positive or negative reinforcement to an individual, ensuring that they will continue in or leave the profession (Murnane, 1984).

One theory posits that the greater the amount of experience attributes or performance attributes present in a given employment contract, the more likely attrition will occur. This theory helps explain why newly graduated teachers are more likely to leave teaching than new teachers who are returning to the workforce. Young, new college graduates probably will have more experience attributes than, say, an older individual returning to the labor force with some previous teaching experience. School districts seem to recognize these differences when hiring by usually preferring the experienced teacher, except when under pressure to keep salaries low.

In addition to the uncertainty and incomplete information about other job prospects and the uncertainty involved in the actual job choice, several life-cycle-specific factors that change alternatives open to teachers—such as marriage, birth of children, and relocation—can determine the timing and occurrence of a job separation.

Changes in Family Status or Residence after Job Acceptance

The initial decision to accept a specific job is conditioned on the existing family status and choice of residential location. However, a change in either of these will cause the individual to reevaluate the initial decision in the light of these new circumstances. The likelihood of changes in family status or residence tends to be fairly high for individuals in the early career stage as Tables 2.1–2.3 show. Teachers are likely to enter the labor force single but have a high likelihood of experiencing marriage, birth of children, and relocation during their initial years of teaching. These changes often involve either attrition from a district or from the profession.

Table 2.1 shows the probability of a first marriage for young male and female Americans by age group and race. Approximately 24 percent of white males and 33 percent of white females marry between the

Table 2.1

PROBABILITY OF FIRST MARRIAGE, BY SEX, AGE, AND RACE

Sex and Age	White	Black
Males		
18 to 19 years	5.8	1.3
20 to 24 years	24.1	14.4
25 to 29 years	36.0	34.0
Females		
18 to 19 years	16.9	4.0
20 to 24 years	32.6	24.5
25 to 29 years	29.9	30.9

SOURCE: Bureau of the Census, "Marital Status and Living Arrangements, March 1982," *Current Population Reports*, Series P-20, No. 380.

ages of 20 and 24. These first marriage rates increase for ages 25 to 29 for white and black males and black females. However, for white females, marriage rates decline for the 25 to 29 age group. Blacks have a somewhat lower marriage rate, with males and females following a similar pattern.

The importance of this table lies in the fact that for these age groups (of which new teachers are largely composed), marriage will necessarily involve some adjustment. It increases the probability of moving as well as having children. Table 2.2 shows fertility rates for 1982 by age. The table makes evident that women in the 21–28 year age range have the highest probability of childbearing. Because a large proportion of teachers are female and most women still assume the traditional childrearing responsibilities, it is clear that women in the early phases of their career are at greatest risk for such changes, hence for reevaluating their original decision. Separations for these reasons may be permanent if domestic activities are valued very highly or may prove temporary, in which case the individual will reenter the labor force when the preference for domestic work declines.

Another reason for expecting higher rates of attrition during the early career years is the prevalence of geographical mobility among this group.

The propensity to move varies in well-known ways for the general population (see Morrison, 1971; DaVanzo and Morrison, 1982). Migration rates peak among individuals in their early twenties and decline

Table 2.2

FERTILITY RATES FOR 1982, BY
SINGLE YEAR OF AGE AND RACE
(Live births per 1,000 women)

Age	Total	White	Black
20	103.6	94.9	153.2
21	111.2	104.3	152.3
22	117.3	111.9	149.1
23	121.7	117.0	143.3
24	123.6	120.0	135.8
25	122.8	120.5	126.1
26	119.7	118.7	116.1
27	114.3	114.7	108.5
28	106.2	106.9	100.3
29	96.1	96.1	92.6
30	83.8	82.9	82.7
31	71.2	70.5	72.5
32	59.0	59.0	63.1
33	48.4	48.3	51.1
34	38.7	38.5	43.2
35	30.5	30.1	36.7

SOURCE: Bureau of the Census, "Projections of the Population of the United States by Age, Sex, and Race: 1983-2080," *Current Population Reports*, Series P-25, No. 952.

with age. Blacks migrate less frequently than whites. Individuals with higher educational attainment migrate more often than those with lower educational attainment. Migration is also closely linked to marriage and family formation, with the first few years after marriage being a period of frequent moves.

Table 2.3 presents data on the percentage, by age and sex, of college graduates moving to another county or another state in 1982–1983. It is clear that those between 25–29 years move frequently with the proportions being almost identical across sexes.

An underlying cause of mobility may be a job change for the spouse. We have some evidence to show that white males, age 25–44, have separation rates from full-time jobs of nearly 16 percent, 13 percent for black males. Finding or accepting a new job may well require relocation which could increase attrition among teachers, either temporarily or permanently as alternative employment opportunities in the new location are sampled.

Table 2.3

ANNUAL PERCENTAGE OF COLLEGE GRADUATES MOVING OUT OF COUNTY OR OUT OF STATE, MARCH 1982-MARCH 1983, BY AGE AND SEX

	Male		Female	
Age	Out of County	Out of State	Out of County	Out of State
25–29	15.4	6.9	14.6	7.0
30–34	6.8	5.3	8.5	4.6

SOURCE: Bureau of the Census, "Geographical Mobility: March 1982 to March 1983," *Current Population Reports*, Series P-20, No. 393.

We have seen that voluntary attrition is more likely to occur early in the teaching career. Below we will see that involuntary attrition is probably more likely for younger teachers as well.

INVOLUNTARY TEACHER ATTRITION

Involuntary attrition can be caused by poor performance, reductions in force, and other reasons. The latter category can include mandatory retirement, death, and illness. Two reasons explain discharge decisions on the part of the school system. The school in hiring a teacher is subject to much the same sorts of uncertainty and incomplete information as the teacher himself. Some attributes of the new hire are observable and measurable by inspection through examination of credentials, school grades, activities, and in the interview process itself. Other attributes, however, become evident only after the teacher has been in the job for a time period. Table 2.4 illustrates these attributes from the school's point of view.

Critical values exist for these attributes and teachers are discharged if the performance level falls below some threshold level. The threshold level itself may be a function of perceived future shortages or perceived difficulty or ease of replacement. For instance, tighter standards may be enforced if a teacher surplus exists as opposed to a teacher shortage. These standards may also be influenced by the presence of teacher union rules and procedures for terminations and by various apprenticeship programs. However, it is likely that performance will be observed soon after initiation of teaching and most attrition for this cause will be early in the career.

Table 2.4

INSPECTION AND EXPERIENCE ATTRIBUTES OF TEACHERS

Information Sought by	Observable by Inspection	Observable by Experience
School	Wage demand, age, race, sex, employment record, certification information, school performance interview information	Actual performance, reliability, flexibility, creativity, contribution to schoole morale, etc.

Another aspect of involuntary attrition concerns emergency certifications. Teachers hired with incomplete certification usually are given a time limit to complete the process. Failure to complete the process can result in termination. This type of termination usually occurs in the early years of teaching also.

Failure to achieve recertification can also result in termination, although this probably occurs infrequently. Each state establishes requirements and timing of issuance of recertification. This recertification usually involves achieving educational objectives. Since recertification can occur five or ten years after entry, attrition because of recertification problems probably hits mid-career teachers.

Another cause of involuntary termination is reductions in force. RIFs were common in the late 1970s and early 1980s and left a sizable imprint on historical attrition data. RIFs occurred at a time of decreased demand for new teachers. This decreased demand was caused by two factors: decreased enrollments after the passing of the baby boom and lower voluntary attrition levels among the more experienced teaching force. The timing of the RIFs often depended on fiscal circumstances in individual school districts, the pace of school consolidation, and other individual district-specific factors.

When RIFs occurred they tended to fall more heavily on both younger and older teachers although the mechanisms were very different. Attrition rates for older teachers increased during a RIF because more generous early retirement plans often were available or individuals simply chose to retire earlier. Attrition rates for younger teachers increased because RIFs often were based on seniority.

RIFs not only affect attrition rates in the year of occurrence but also depress voluntary attrition rates in the years following. This is because many younger teachers who were terminated during a RIF might have left in the following years, and many older teachers who retired during a RIF would have retired shortly thereafter anyway.

Thus, time-series models of teacher attrition must not only take account of RIFs but must account for this lagged effect on voluntary attrition. Otherwise, predictions of future levels of attrition will be inaccurate.

The final category of involuntary attrition includes mandatory retirement, illness, and death. Ideally, it is important to separate these categories from other attrition, since policies aimed at preventing attrition would not affect these individuals. This type of attrition, of course, would increase with age and have slightly different patterns for men and women.

SUMMARY: VOLUNTARY AND INVOLUNTARY ATTRITION BY CAREER OR LIFE CYCLE STAGE

The theoretical framework outlined above highlights the fact that *voluntary* attrition decisions depend crucially on six factors:

- The degree of acquired occupation-specific, location-specific, and firm-specific human capital.
- The informed nature of the original job commitment and the nature of the original job search.
- The previous work and teaching experience of the teacher at entry.
- The probability of changes in marital status, family composition, and residential location after employment.
- The salary and working conditions of teachers.
- The job characteristics and wage levels of alternative opportunities both inside and outside teaching.

Involuntary attrition decisions depend on:

- The probability that the performance characteristics of the teacher will meet some threshold level set by the school district.
- The chance of teacher layoffs, which is primarily influenced by enrollments, fiscal environment, and perhaps union rules.
- Mandatory retirement rules.
- Illness and death.

Programs and policies should focus on early attrition not only because there is great risk of attrition early in careers but also because prevention of attrition then has a potentially high payoff. If teachers stay through the early turbulent years, they will likely make teaching a career, providing an additional 20–30 years of teaching service. However, it is also extremely important to make choices at this stage as to which teachers to retain. Poor choices can result in long, nonproductive careers as well.

We have now placed teacher attrition in a context of life cycle and career patterns. The next section reviews the recent literature on teacher attrition. In Sec. IV, we present analyses of both cross-sectional and time-series data from several localities. These analyses provide some verification of the hypotheses deriving from the theory presented above.

III. REVIEW OF THE RECENT LITERATURE ON TEACHER ATTRITION

Studies of teacher attrition (broadly defined, as we explained above, to include both teacher mobility across school systems as well as separation from teaching) vary considerably in their sample sizes, methodology, and level of sophistication. The literature does not lend itself easily to categorization but the foci of the studies appear to revolve around (a) reported reasons for attrition, (b) determinants of attrition behavior, and (c) elementary survival analyses of teacher cohorts. Clearly, these foci overlap to some degree and equally clearly, some studies address more than one issue. We feel, however, that characterizing studies by their major focus is helpful in assimilating and summarizing the principal findings on teacher attrition.

We present here only a selective review of the literature. The report, however, contains a more comprehensive bibliography.

REPORTED REASONS OR PLANS FOR ATTRITION

Identifying the reasons why teachers leave schools, school districts, and the teaching profession can provide a useful perspective when establishing policies of teacher salaries, working conditions, and hiring. High levels of attrition are often interpreted as a signal that salary and working conditions may be noncompetitive. In the labor market, "voting with one's feet" is considered the ultimate act of dissatisfaction with a job or an occupation.

However, many leave jobs not because of dissatisfaction with pay and working conditions but simply in response to more pressing life cycle or career stage demands. Others leave jobs they would like to keep—either because of unsatisfactory performance or perhaps illness. Some leave expecting to return to a job they liked. Thus in interpreting attrition data for policy purposes, it is important to understand and measure the reasons for leaving and the actual rate of return.

Unfortunately there do not exist well categorized, regularly collected data from leaving teachers on their reasons for leaving. The literature does contain a national series collected by NEA on teacher intentions for the next year with categories for those expecting to leave. It also contains many local and smaller sample studies done to collect reasons for leaving. Because these studies often have different definitions of attrition, and have different categories of reasons for leaving, it is difficult to compare reasons for attrition across areas and across time. Such data can provide only rough estimates for broad categories of reasons for leaving.

The NEA survey of teachers provides the most comprehensive data on reasons for attrition, containing data collected since 1966 and a reasonable sample size. It asks teachers to report their probable activity in the following year. However, possible response rate bias and the bias resulting because the questions focus on intentions rather than actual experience make one cautious in interpretation of trends.

From 1966 through 1976, the major reported reason for planning to leave was to teach in another school district (see Table 3.1). Approximately 30–40 percent of teachers revealed such an intention. This number dropped significantly in the 1981 survey, to only 14 percent. This drop would be expected in view of the older age composition of the teaching force in that year and the tightness of the internal labor market, resulting from large enrollment decreases in the late 1970s and early 1980s.

The next most common reason for planning to leave in each year was for homemaking, accounting for approximately 15–20 percent of those planning to leave. Jobs outside of teaching have accounted for an increasing proportion of planned separation between 1966 and 1981. Although only 10 percent planned other jobs in 1966, 19 percent planned outside jobs in 1981. Still, only about 2 percent of the teaching force plans to leave for outside jobs each year, and some of these individuals are separated involuntarily.

Retirement and school attendance are next in importance, accounting for between 10–15 percent and 8–10 percent, respectively. Finally, unemployed and other categories have accounted for an increasing share of planned separation between 1966 and 1981. In 1966 these categories accounted for only 8 percent; in 1981 they accounted for 27 percent. The combination of a tight teacher labor market and a tight nonteaching labor market in 1981 left a high proportion of teachers without jobs. A proportion of these teachers may have been involved in RIFs and are simply waiting to return to teaching as openings occur.

If we assume that teachers carry out their stated plans in the NEA survey, then the NEA data can be used to develop broad estimates of more policy-relevant categories of teacher attrition. The first is to determine what proportion of teachers who leave will continue to teach elsewhere or will return to teaching in the future. Presumably these are teachers who are not greatly dissatisfied with their profession.

Since the NEA estimates involve attrition from a district, we will be estimating the proportion of teachers leaving a district who will return

Table 3.1

REPORTED PLANS FOR FOLLOWING YEAR FOR TEACHERS LEAVING SCHOOL DISTRICT

	1966		1971		1976		1981	
Activity	% of Active Teachers	% of Teachers Leaving District	% of Active Teachers	% of Teachers Leaving District	% of Active Teachers	% of Teachers Leaving District	% of Active Teachers	% of Teachers Leaving District
Teaching in another school system	5.7	39.3	4.8	31.4	3.9	30.7	1.8	14.2
Attending school	1.7	11.7	1.4	9.2	1.3	10.2	0.9	7.1
In military service	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.8
In nonteaching position	1.5	10.3	2.1	13.7	1.9	15.0	2.4	18.9
Homemaking	2.9	20.0	3.2	20.9	2.1	16.5	2.4	18.9
Unemployed and seeking work	0.4	2.8	0.3	2.0	1.1	8.7	1.1	8.7
Retired	1.5	10.3	2.2	14.4	1.5	11.8	1.7	13.4
Out of labor force and other	0.8	5.5	1.3	8.5	0.9	7.1	2.3	18.1
	14.5	100.0	15.3	100.0	12.7	100.0	12.7	100.0

SOURCE: NEA (1981).

to teaching in the future. All of those planning to switch school systems will be included in the count of returning teachers. One might also expect reentry from many who return to school and the home. However, smaller proportions might also be expected to return from the categories of nonteaching position, unemployed and seeking work, and out of the labor force. Table 3.2 shows estimated return rates under reasonable assumptions involving the proportions who return from these categories.

For the three years of 1966, 1971, and 1976 the estimates show that around 50 to 60 percent of teachers might have returned. The drop to around 30 percent for 1981 seems large and might be explained by two factors. First the large increase in the group leaving the labor force in 1981 may indicate a high number of teachers caught by reductions in force. If this is true, many of these teachers may wait outside the labor force and return when openings occur. In that case, we have underestimated the number of teachers returning in 1981 in our simple formula, and a better estimate may be in the 40 to 50 percent range.

A second explanation is that declining enrollments and demand for teachers in the late 1970s and early 1980s simply made interdistrict mobility more difficult than in previous years. This means that moving teachers (often moving because of spouse moves) could not often get jobs immediately and possibly stayed out of the labor force until a teaching or another job became available. In this case also we have probably underestimated the number of returning teachers with our simple formulas. Taking account of these hypotheses, a "best

Table 3.2

ESTIMATED PERCENTAGE OF RETURNING TEACHERS FROM NEA DATA

Estimate	1966	1971	1976	1981
Lower[a]	55	46	44	27
Middle[b]	62	54	52	36
Upper[c]	67	59	57	43

[a] Assumes return of all transfers and one-half of homemakers and students.

[b] Assumes return of all transfers and two-thirds of homemakers and students, and 10 percent of nonteaching, unemployed, and out of labor force.

[c] Assumes return of all transfers and three-fourths of homemakers and students, and 20 percent of nonteaching, unemployed, and out of labor force.

estimate" would be that in earlier years 50 to 60 percent of teachers leaving a district return to teaching, but that number may have declined to 40 to 50 percent recently with the tighter teacher labor market of the 1980s.

The remaining group of teachers—those not returning—consist of those retiring, those staying out of the labor force, and those taking other jobs. Some proportion of those in other jobs and out of the labor force were dismissed because of performance and would not be rehired. Unfortunately the NEA data do not allow estimates of the dismissed group. We will assume that only 5 percent of leaving teachers were dismissed and that 12 percent retire. The estimate of the proportion of teachers leaving permanently for reasons other than retirement or dismissal would be between one-third to one-fourth of leaving teachers for 1966, 1971, and 1976, and around 30 to 40 percent for 1981.

This group of teachers—those permanently leaving for reasons other than retirement or dismissal—should clearly be one major focus of study in attrition research. Unfortunately, there are no national data and only limited state data to identify such individuals. There clearly is a need to develop better teacher attrition data to allow consistent and accurate estimates of teacher attrition by policy-relevant categories of attrition. We should not have to depend on "planned activities" of teachers to develop such estimates, we should be able to ask leaving teachers. We also clearly need to follow teachers to determine what proportion return and when they return. Such data should be collected nationally so that returning teachers can be followed over state lines.

Although the NEA data present the most consistently collected data on reasons for leaving, further evidence on reasons for attrition comes from Keeler (1973), Bowman (1984), Clayton and Wilson (1984), and a 1985 Metropolitan Life Survey of current and former teachers. Keeler presents data for 1959–1960 (Table 3.3) showing that 40 percent of separations are accounted for by interdistrict transfers—a figure that agrees closely with the 1966 NEA "plans" estimates. The other categories do not match for the two sources. The data show a dismissal rate of 13 percent, a leave and retirement rate of 9 percent, and a death rate of 10 percent. The data show expected differences between men and women. Women have higher rates for leave and retirement but lower rates for transfers and dismissal.

Keeler also compared NEA "plans" data with actual reasons for leaving given in surveys in the late 1960s and early 1970s (reproduced here as Table 3.4). The categories again do not match, but if one redistributes the leaves of absence into homemaking, returns to school, and jobs outside education, the plan and actual reasons are roughly equivalent. The data show that retirement, homemaking, returns to

Table 3.3

PERCENTAGE OF TEACHERS LEAVING PUBLIC ELEMENTARY AND SECONDARY SCHOOLS, BY SEX, FALL 1959 TO FALL 1960

Reason for Leaving	Total	Men	Women
Total separations	13.4	12.6	13.8
On leave of absence	9.0[a]	5.0[a]	10.0[a]
Retired	8.0	5.0	10.0
Deceased	2.0	2.0	2.0
Dismissed	13.0	19.0	10.0
Changed to nonteaching job in same district	3.0	7.0	2.0
Transfers (includes only interdistrict)	40.0	50.0	36.0
Other separations	26.0	14.0	31.0

[a] Percent of separations.

school, and death or illness account for approximately 75 percent of total leaving teachers. This is further borne out by the evidence in Table 3.5, which Keeler compiled from Social Security file data.

Bowman's study suffers from small sample sizes, nevertheless his data show the same trends. Among 41 resigned teachers, one-fourth were resigning to accept another teaching position, generally in another school district, and relocation of spouse was cited by another one-fourth of the respondents as the reason for the resignation.

Clayton and Wilson, using data on 138 nonreturning teachers in Alabama, found that 47.2 quit teaching entirely (43.1 percent for personal reasons, 56.9 percent for job-related reasons) and the remaining 52.8 percent transferred to other districts. Relocation as a result of marriage was the major personal reason for changing systems, having children the major personal reason for leaving education.

A 1985 Metropolitan Life Survey of 1,846 current public school teachers and 500 former teachers (who had left teaching within the past five years for another occupation) revealed some interesting findings regarding the attitudes and experiences of former teachers (Metropolitan Life, 1985). It should be emphasized that this survey deals only with those teachers leaving for other occupations (a small proportion of those leaving); it may be somewhat biased toward those doing well, since the sample was collected from former teachers and principals.

The study highlights the fact that career change results on average in a marked increase in salary, lower job stress, and higher job satisfaction for these former teachers. Although half of the respondents said

Table 3.4

PERCENTAGE DISTRIBUTION OF TERMINATING TEACHERS, BY REASON

Reason for Leaving	San Diego 1970[a]	United States 1967[b]	NEA, United States, 1966[c] (Planned)	NEA, United States, 1971[c] (Planned)
Rate of termination	4.9	4.2-7.5	8.8	10.5
Reason for termination				
Retirement	33	29	17	21
Children and homemaking	27	21	33	30
Return to school	8	15	19	13
Job outside education	8	16	17	20
Promotion	4	—	—	—
Dismissal	3	—	5	3
Death, illness	7	11	—	—
Other	10	8	9	13
Leave of absence	1.4	2.0	Incl.	Incl.

SOURCE: Keeler (1973).

[a] Data have been adjusted to account for the 8 percent of terminees from San Diego who transferred to another district. The 27 percent who said that they moved or their spouses moved were assumed to divide as follows: 10 percent transferred to another teaching job, 5 percent went to childrearing and homemaking, 2 percent retired, 1 percent returned to school, 2 percent went to jobs outside education, 7 percent left teaching for just one year (a kind of leave of absence).

[b] Unpublished work on the RAND Social Security file of workers (Keeler, 1973).

[c] These figures include leaves of absence. Because these are plans, there is no death or illness. Promoted teachers are counted as holdovers.

Table 3.5

TERMINATION TRENDS BY CAUSE, 1965

Reason for Leaving	Percent
Retirement, death, illness	30
Children/home responsibilities	25
Other personal reasons:	
School, travel, rest	15
Moved or spouse moved	10
Nonteaching job in education	10
Job outside of education	10

SOURCE: Keeler (1973).

they miss teaching, 83 percent said they were unlikely to return to the classroom. Poor salaries and poor working conditions were the most frequently cited reasons for leaving. Lack of professional prestige also was underscored. Most transferred to jobs that used related skills, although half of them did require further education or training to qualify for the new job. These jobs tended to be managerial, executive, sales, or professional specialty positions.

DETERMINANTS OF ATTRITION BEHAVIOR

Studies of internal and external mobility (Greenberg and McCall, 1973 and 1974; Pedersen, 1970; Harnischfeger, 1973; Jacobsen and Sweet, 1982) have produced important evidence on the attrition patterns of men and women and provide significant tests of the age and experience hypotheses explicated in the previous section. All the studies confirm the U-shaped external attrition curve for both men and women. The earlier Greenberg and McCall study, done in San Diego for the 1971–1972 school years, also found that the U shape of the curves was different for men and women. Women had markedly higher attrition rates early and late in their careers than men but had nearly equal rates during mid career. The higher early attrition rates for women were attributed to less promotion opportunity in the system and to family responsibilities. Keeler (1973), however, found that the inclusion of age-specific fertility rates eliminated almost all of the men/women attrition differentials.

Assignment to junior high or senior high schools appears to be associated with higher attrition, as is lower socioeconomic status of the school district and lower ability of the student population. Additional evidence from Jacobsen and Sweet shows that men are more likely to move into administrative positions or to leave for another profession, whereas women tend to move into clerical or service occupations.

Internal mobility appears to be largely influenced by the socioeconomic status of the students, teaching assignment, and student ability (Greenberg and McCall, 1979). Student characteristics influenced teacher mobility in the expected direction with teachers moving toward districts with students with higher cognitive ability. Younger teachers typically were assigned jobs in lower status schools, and as teachers gradually gained experienced they tended to move to schools with higher socioeconomic status. Older teachers thus had lower internal mobility rates, since they were more likely to have settled at schools where nonpecuniary returns were the highest. A likely inference we can draw from this is that greater opportunities to achieve a better teaching status within the district may lead to less attrition of younger teachers outside the system. Interestingly, men had a higher interdistrict mobility rate than women, perhaps reflecting their need to achieve higher income as the primary earner.

Comparisons of the quality of those remaining in the teacher workforce and those who left reveal a strong negative correlation between measured academic ability and retention in teaching (Schlechty and Vance, 1981). However, Greenberg and McCall (1974) found that higher educational attainment was related to lower attrition. Murnane (1984) also shows that it is the least effective teachers (as measured by students' test score gains instead of by teachers' test scores) who tend to leave early. There can be several explanations for the differing results, and these explanations again point to the need to gather improved national attrition data on reasons for leaving and to identify those who may return. Besides the possibility of different measures of ability and different school districts and times of measurement, the composition of the attrition group matters. Both high and low quality teachers may leave at any given time. However, the quality of individuals leaving will probably depend quite sensitively on the reason for attrition. Those leaving voluntarily for other jobs, returning to school, and transferring would likely be of higher quality. Those dismissed, unemployed, or out of the labor force might be of lower quality. Furthermore, it is not clear that this measurement is very useful unless one determines who returns from the sample leaving. Higher quality teachers may return at greater rates than lower quality teachers.

The question of the responsiveness of teacher attrition to earning differentials both within and outside the occupation is an important one. Two studies appear to find a negative but relatively small effect (Keeler, 1973; Greenberg and McCall, 1974).

In particular, the latter study showed that altering the four year out-of-state attrition rates (28 percent) by a single percentage point would require a salary increase of approximately 6 percent. Dissatisfied teachers appear to attempt to change schools or districts and to improve both pecuniary and nonpecuniary conditions rather than quit. Overall the study concluded that districts that are dissatisfied with their turnover rates can do little to alter the factors that influence whether a given teacher stays or leaves.

However, other studies conclude that salary differentials appear to be important in determining interdistrict mobility, particularly for men. This was confirmed by Pedersen (1970). Both Zabalza (1978) and Pedersen stress the importance of accounting for lifetime earnings in studying attrition. For example, Zabalza found that salary differentials have an important influence acting both as an attraction as well as a retention factor. A significant implication of his research is that teachers react not only to immediate salary differentials but to expected future earnings as well.

This is further borne out by Baugh and Stone (1982a) who used the Current Population Surveys, May supplement, to look at this question. They find that educators are at least as responsive as other workers to interoccupational wage differentials in deciding to change occupations (or districts, although to a lesser degree).

An excellent and comprehensive set of papers by Eberts (1982a, 1982b, 1982c) analyzed the determinants of teacher turnover among New York school teachers over the period 1972–1977. He categorized turnover as including quits (transfers to other districts), transfers (among schools in the same district), and changes in teacher assignment. Two of the papers use personnel data obtained from the New York State Department of Education; the third uses national survey data on 3,000 elementary teachers in 200 districts. Eberts delineates a theory of teacher turnover similar to the one we described above, using strands from a theory of internal labor markets and a theory of institutional work rules to help explain both voluntary and involuntary attrition. The synthesis provides hypotheses regarding the effect of acquired human- and location-specific capital on mobility and the effect of contract provisions and state labor laws on teacher layoffs.

The particular period under study was characterized by teacher surplus, declining enrollments, and budget reductions. As a result, the logit analysis undertaken by Eberts showed that class size provisions and reductions in force provisions based on seniority significantly affect teacher quits and transfers, although in different ways. Transfers appeared to follow the hierarchy of seniority with younger teachers being at greater risk, albeit in an inverse relationship, as did quits. The findings are important in that they replicate to a large extent the findings of Murnane (1981), who implicitly considered the effect of institutional rules on teacher mobility (although his data were limited to observations on a single district). He found that as the district went from a period of increasing to decreasing enrollment, mobility patterns reflected more institutional work rules rather than primarily teacher preferences.

The issue of teacher alienation and teacher turnover was examined by Croft et al. (1983) who analyzed data on over 3,000 teachers from a large urban school district in a southwestern metropolis. Contrary to popular opinion, they find little to suggest that principals drive teachers away from teaching, or indeed that they sustain and nurture teachers in their professional performance. Alternative opportunities and appropriate skills are what matters in determining attrition.

Alienation is a contributor but the style of the principal plays a very small role in causing such attitudes.

Chapman (1984) used data on teaching certificate recipients from the University of Michigan to analyze differences among (a) those who started in and remained in teaching, (b) those who started in and subsequently left teaching, and (c) those who prepared for but never actually entered teaching. The single strongest predictor of retention was initial commitment to teaching; academic performance in teacher preparation did not appear to be related to attrition. There was some evidence to suggest that those who left tended to report low levels of career satisfaction even in subsequent jobs and to be unsure about career decisions. Those who never entered teaching, on the other hand, reported the least initial commitment to teach, the highest levels of job and life satisfaction, and greater career mobility.

Finally, one study (Greenberg and McCall, 1979) found that—other things equal—teachers obtaining degrees from out-of-state schools have higher attrition than those with in-state degrees. In times of rising teacher demand and more out-of-state recruiting, these findings could point to somewhat more upward pressure on attrition rates.

SURVIVAL ANALYSES OF TEACHER COHORTS

Some studies have approached teacher attrition with simple survival analysis. These in general consist of a univariate type analysis, looking at the survival rates over time of different homogeneous subgroups without attempting to fit parametric distributions or to use the multivariate methods more common today (Cox and Oates, 1984).

This was first used by Whitener (1965) to examine turnover rates in 10 Missouri school districts for teacher cohorts of 1951, 1952, 1953. The approach was refined and extended by Charters (1970) who used it to analyze 1962–1963 data from Oregon. Mark and Anderson (1978, 1985) later used the same technique for studying survival rates among teachers in the St. Louis Metropolitan area, from 1969–1982. This allowed them to examine several different cohorts and provided a much longer period of observation at least for the earlier cohorts.

The findings from the studies are remarkably consistent. Gender and age (predominantly for females) tend to stand out as prime determinants of survival. The U shape of the attrition curve is also borne out, with attrition being very high during the first five years. For example, Whitener found that only 38 percent of the total cohort survived through five years; however, 75 percent of those who survived remained during the following five years. Charters found that for males, school district size also tended to be important. This latter may be serving as a proxy for salary opportunities and availability of senior administrative jobs. Charters points out in a useful discussion that age itself (except in the case of retirement) is not a force acting directly on separations; instead it reflects underlying physiological, cultural, economic, and social forces that change with age. He stressed the importance of adopting a life cycle approach when analyzing survival of female teachers.

Mark and Anderson (1978) confirmed the general trend of downward sloping survival curves but found significant differences among cohorts. For example, proportion surviving beyond one year increased from 64.7 percent for the 1968 cohort to 83.6 percent for the 1973 cohort and this shift upward held through the latter years. There was also evidence to show that the large differential reported by Charters between the survival rates of men and women appeared to be decreasing over time. Their later study was consistent with the earlier study. For each cohort there were rapid decreases in early years of teaching, with declining percentages dropping out in later years. Differences were again found across cohorts, with maximum survival rates occurring in cohorts who entered teaching in the early 1970s.

SUMMARY: PRINCIPAL FINDINGS

The findings that emerge from this literature review tend to provide considerable support for the career and life cycle theory of attrition explicated above.

- Most reported teacher attrition can be accounted for by normal and understandable changes in a person's life and a desire for professional and job advancement. These categories of attrition include return to homemaking or school, retirement, death or illness, or a change in teaching jobs from one district to another triggered by a spouse or family-related move or seeking a higher paying or otherwise better teaching position. These categories have in the past accounted for approximately 60–75 percent of teacher attrition at the district level. These categories—with the possible exception of retirement—are relatively immune to educational policy impact.
- Many teachers who separate from a district will return to teaching. The major reason for leaving a district is to teach elsewhere and the second reason is to withdraw from the labor force either to go to school or for homemaking. Many of those who dropped out of the labor force will return to teaching after

finishing school or raising a child. Estimates made here from historical data show that approximately 40 to 60 percent of teachers who leave districts might return to teaching.

- Attrition rates appear to exhibit a strong U-shaped relationship with age and years of experience with high levels of attrition for young and retirement eligible teachers and very low attrition rates in mid career.
- The attrition curve is U shaped for both men and women teachers but women tend to have higher early attrition rates than men, nearly equal attrition rates during mid career, and either the same or slightly higher rates in late career.
- Attrition and mobility are higher among newer teachers. New teachers appear to be more subject to disillusionment, dissatisfaction, changes in family status and residential location, as well as discharges due to a combination of new information acquired by the school and institutional work rules that determine the hierarchy of layoffs during RIFs. They also are more mobile—typically entering teaching jobs with fewer nonpecuniary advantages and gradually finding their way to schools or districts that have higher pecuniary and nonpecuniary advantages. Once there teachers tend to have much lower attrition and mobility rates.
- Other things equal, teachers educated out of state appear to have higher attrition than in-state graduates.
- There is a critical lack of data on teacher attrition. This lack of data makes it difficult to efficiently set teacher salaries and to develop policies aimed at improving the quality of the teaching force. We need to collect improved data on teachers who leave school districts at the national level. These data should be collected using policy-relevant reasons for leaving and should follow teachers longitudinally to find who returns to teaching.

IV. NEW EVIDENCE ON TEACHER ATTRITION PATTERNS

This section presents some preliminary analysis of teacher attrition data, based on both recent cross-sectional data from two states and time-series data from four states. We first describe preliminary results obtained by modeling individual teacher attrition behavior using data from two jurisdictions. The next subsection analyzes time-series data for four states: Illinois, Michigan, New York, and Utah. The analysis is presented as simple tabulations. The attrition rates disaggregated by age, sex, and type of schools represent bivariate relationships, and any differences/similarities observed should be treated with caution. A multivariate model is needed to capture the real effect of these variables. Statistical modeling of data on individuals using logit analysis is in the process of completion but is not included here.

Recent empirical evidence on teacher attrition shows some remarkably consistent and illuminating patterns. Computerized personnel data on approximately 5,000 teachers in the first jurisdiction were analyzed at RAND and data on 35,000 teachers in the second jurisdiction were analyzed by the State Department of Education. We will present primarily results from the smaller jurisdiction, although similar patterns were observed in the larger state as well.

DATA FROM THE SMALLER JURISDICTION

Files available for the analysis were teacher personnel files from 1979 to 1983. We merged the files by Social Security number to build analytic files that allowed tracking of teachers over time to determine (a) if they were returning to teaching or were new to the system and (b) if they were present the following year, were on leave, or had left the school system.

Figures 4.1 and 4.2 display patterns of attrition rates for teachers during the period from 1979 to 1982. Attrition includes all teachers who were present in the teaching force in a given year and absent in the subsequent year. Thus, the attrition rates exclude teachers on temporary contracts who were routinely separated at the end of a school year and rehired for the next year. Except for 1980, when reductions in force resulted in an attrition rate of over 17 percent of the teaching force, annual attrition rates (see Fig. 4.1) have been between about 4

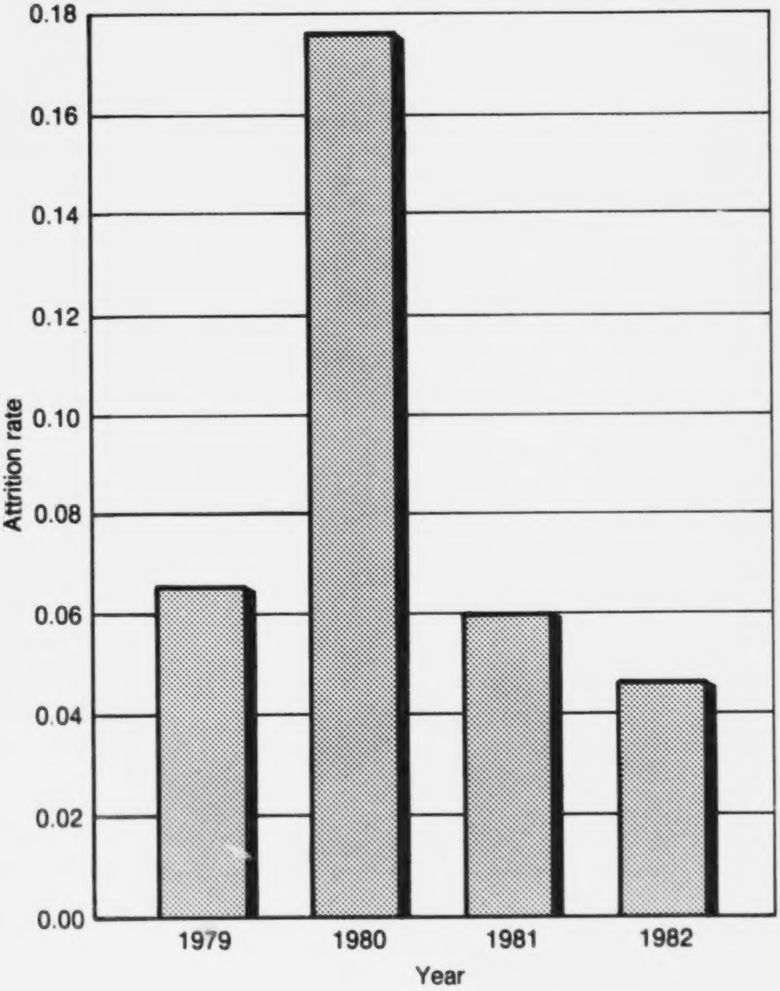

Fig. 4.1—Attrition rates by year

and 7 percent. Attrition (see Fig. 4.2) in each year was highest for younger teachers and those with the least experience, declining through the middle years, and then increasing again during the periods of retirement eligibility (after age 55 and about 25 years of experience).

The very high annual attrition rates for young and inexperienced teachers during the RIF years (1980 and, to a lesser extent, 1981) are undoubtedly due to the procedures by which the reductions in force were implemented. However, even in other years, new teachers left in greater proportions than other teachers. The estimated retention of typical teachers during the first five years of teaching in this system is displayed in Fig. 4.3.[1] The figure shows that the estimated probability of a new teacher staying in the system is about 80 percent after the first year of teaching. By the fifth year of teaching, only 30 percent of men and 50 percent of women would remain if attrition patterns present in 1982–1983 persisted. Thus, over half of all new teachers would leave the district before they reached their sixth year of teaching.

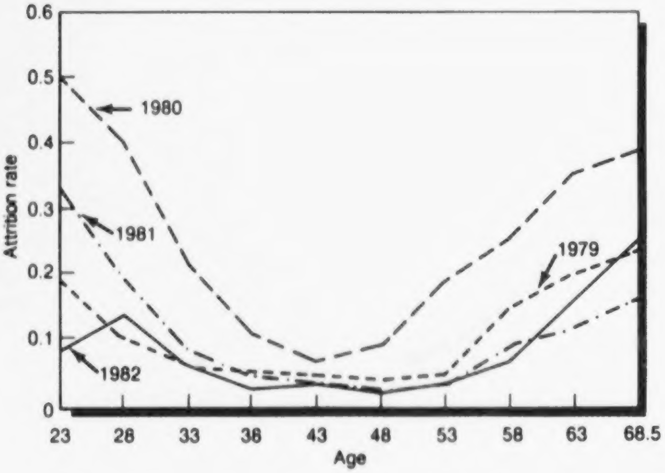

Fig. 4.2—Attrition rate of teachers, by age and year

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[1] The estimates are calculated by multiplying year-to-year survival rates for teachers during their first five years. Survival rates are for the 1982–1983 period.

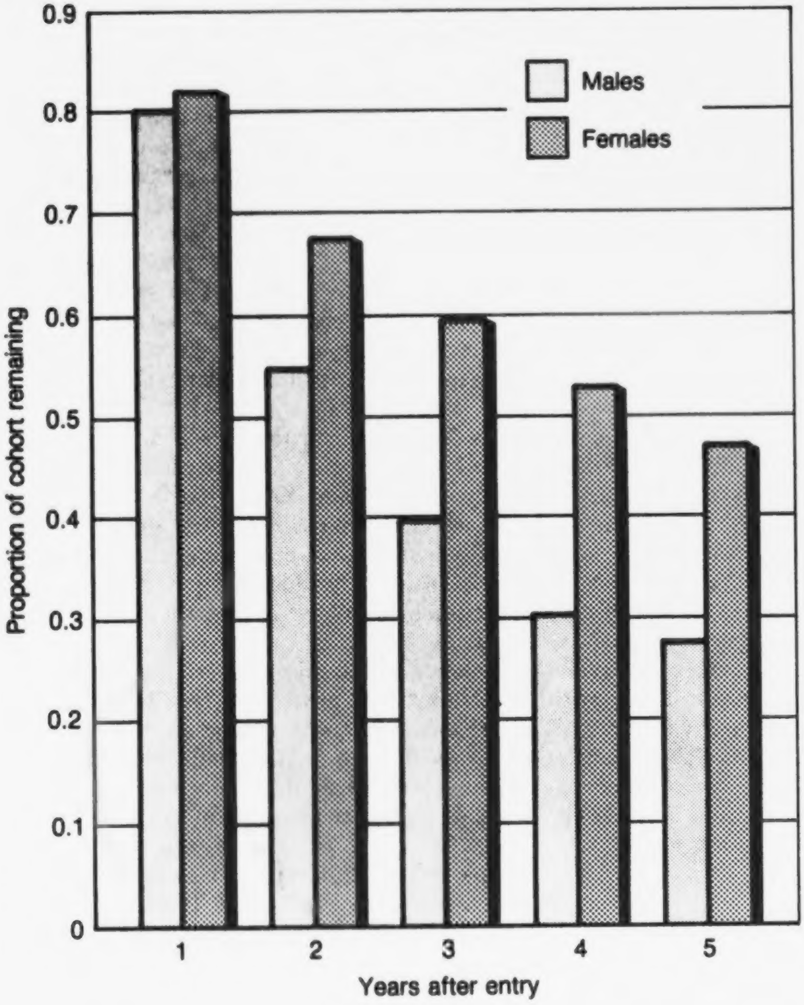

Fig. 4.3—Proportion of teacher cohort remaining during first five years, by sex

When we disaggregate attrition rates by types of teachers, we find as is the case with new teachers, that attrition rates for all teachers are higher among men than women. This may be because men are more likely to leave teaching for other occupations or administrative posts. In 1979, attrition rates tended to increase with education level, although teachers with only a Bachelor's degree had higher rates than those with a BA+15 or Master's degree. This probably reflects the high attrition rates of new teachers, who tend not to have additional credits beyond the BA degree. For teachers with graduate credits beyond the Master's degree, attrition rates reached levels of 9 to 11 percent in 1979. This is probably partly due to retirements of teachers with advanced degrees, and partly due to the increased job opportunities available to those with more years of education. This same pattern was not apparent in 1982, probably because those with advanced degrees who were thinking about retiring or leaving did so during the RIF years, thus temporarily depressing attrition rates for the next few years.

Attrition rates have also tended to vary for teachers of different subjects and in different types of schools. In 1979, attrition rates were highest for teachers in the business education and trades areas, followed by teachers of mathematics and science. In 1982, math and science teachers had higher attrition rates than other categories of teachers. Presumably those types of teachers have greater job opportunities outside the school system; there may also have been more of them near retirement age than in other fields.

Teachers in junior high schools and special education schools also had much higher attrition rates in those years than teachers in either elementary schools or high schools, perhaps because junior high schools and special education schools tend to be rather challenging teaching assignments. One might look to possible improvements in working conditions and teaching loads as factors that might influence retention of these teachers.

Figures 4.4 through 4.6 show the attrition rates of elementary, junior high and senior high teachers by age groups. The U-shaped curves clearly are evidenced for each group. Figures 4.7 and 4.8 show similar data for two specialty groups of teachers—math/science and business vocational. Here also the U-shaped pattern is evident.

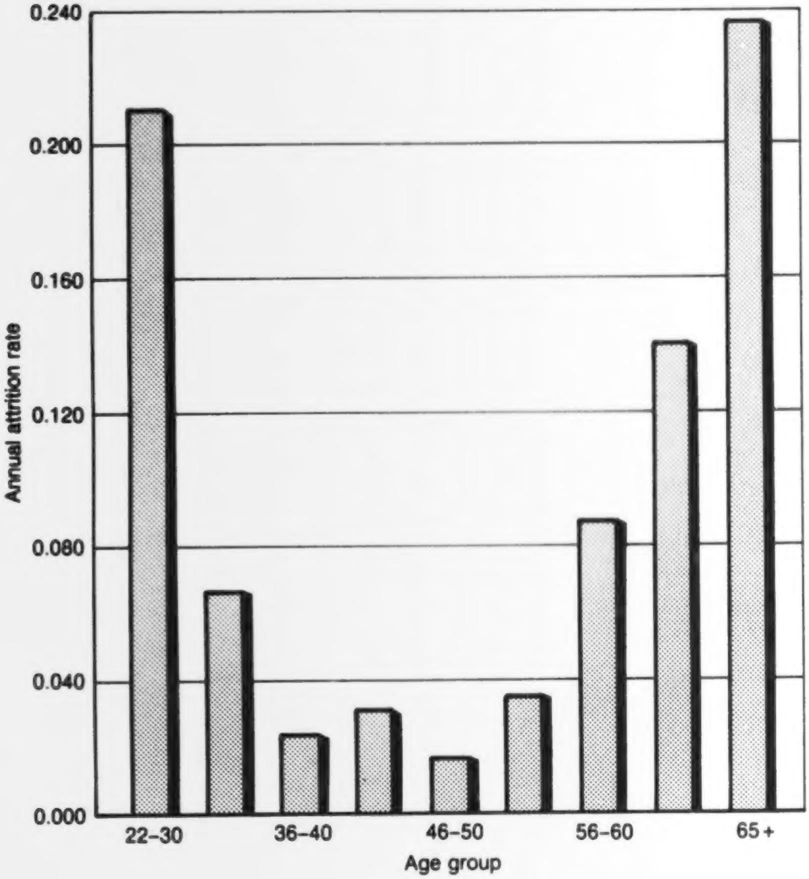

Fig. 4.4—Attrition rate of elementary school teachers, 1981–1982, by age group

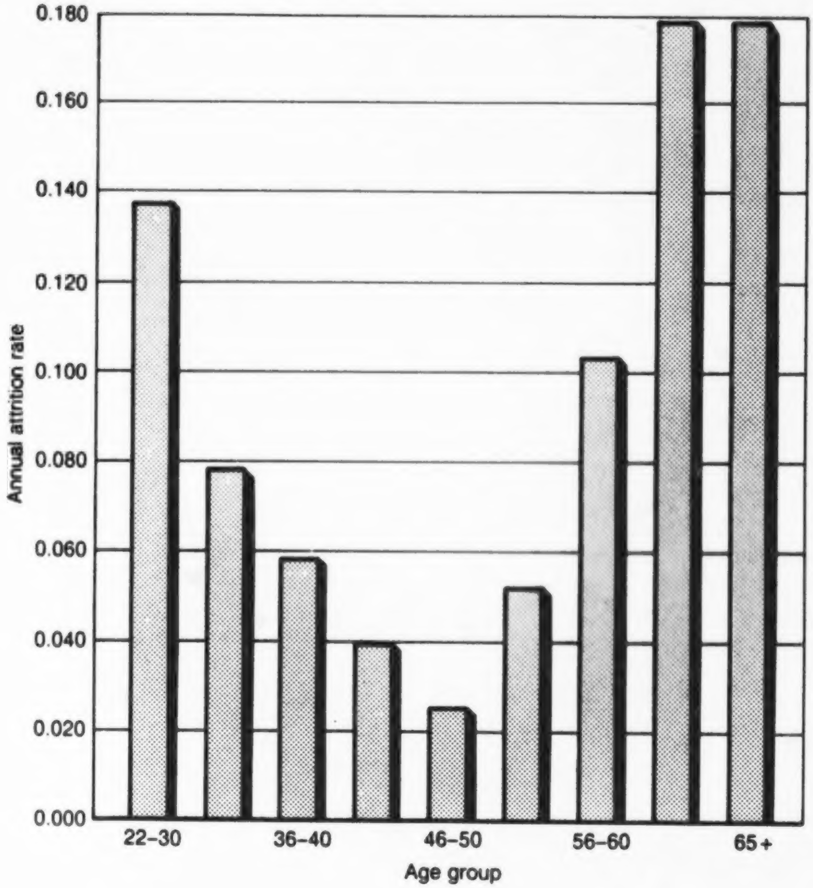

Fig. 4.5—Attrition rate of junior high school teachers, 1981–1982, by age group

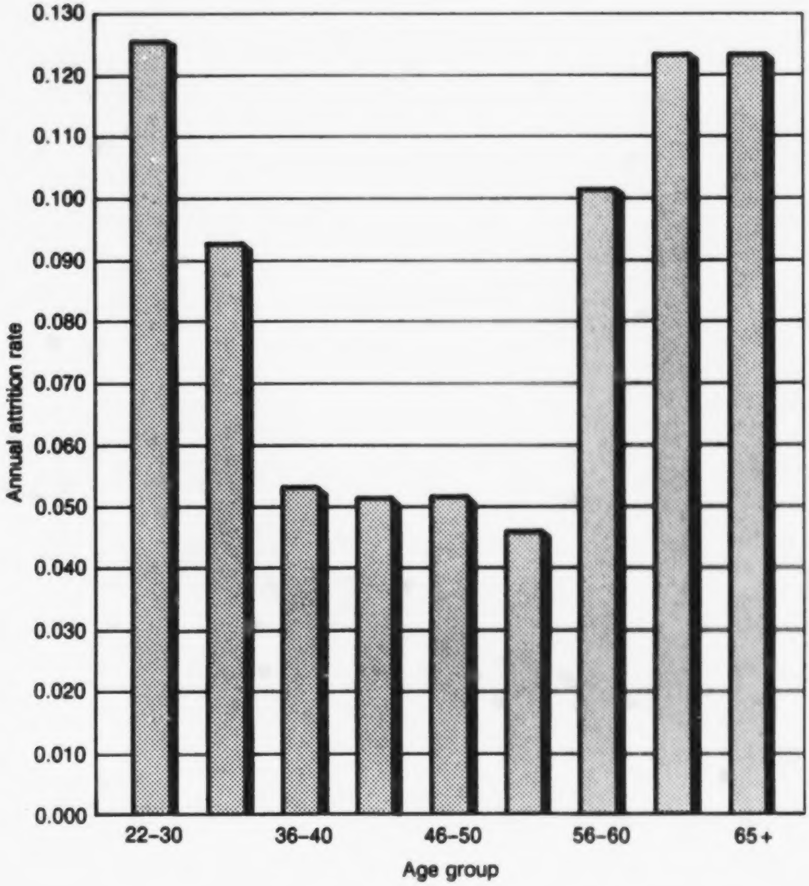

Fig. 4.6—Attrition rate of senior high school teachers, 1981–1982, by age group

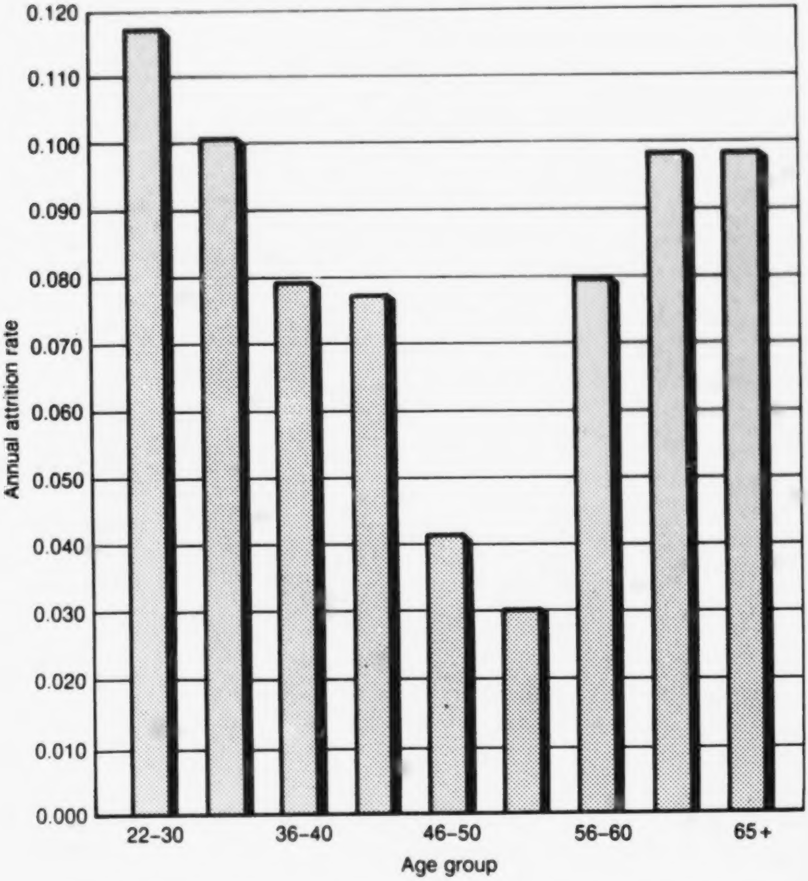

Fig. 4.7—Attrition rate of math/science teachers, 1981–1982, by age group

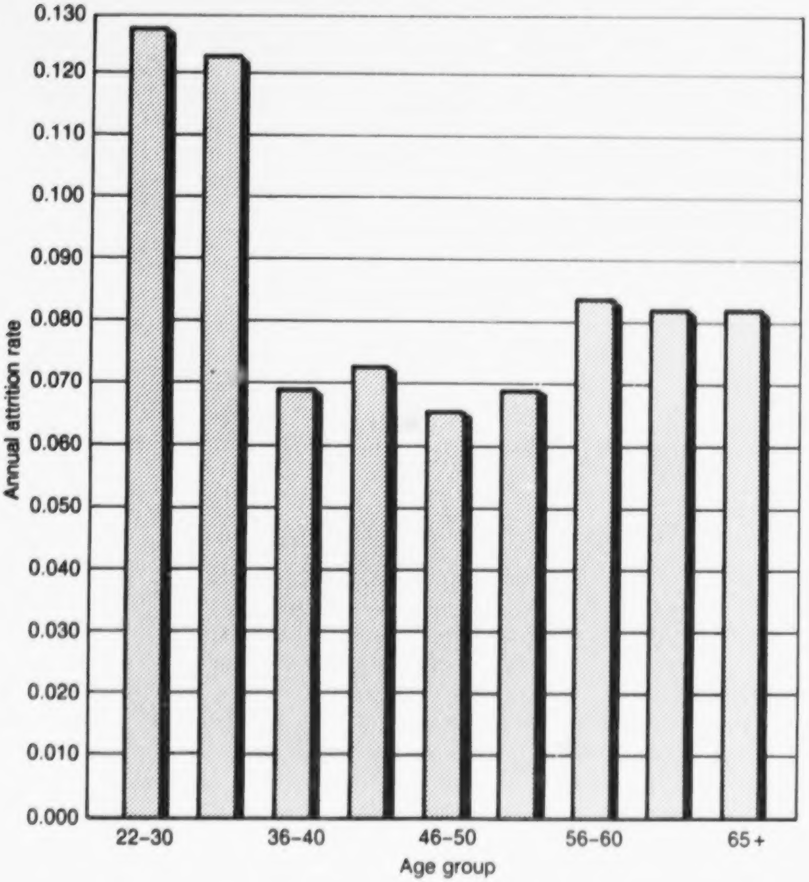

Fig. 4.8—Attrition rate of business/military teachers, 1981-1982, by age group

DATA FROM THE LARGER JURISTICTION

These data allowed more disaggregated analysis by teacher types because of the large sample of teachers. Preliminary results from this analysis support our findings from the previous section.

Attrition rate patterns for the entire teaching force also follow a U-shaped curve (see Fig. 4.9). Annual attrition rates in the early years of teaching were almost 15 percent, dropping to around 10 percent for those with between 25–34 years of age and dropping still further to 3 percent for between 35–54 years of age. As expected, attrition rates began to rise at age 55 with the onset of retirement eligibility and reached 25 percent for those over 65. The U-shaped curve holds for subgroups of teachers shown in Fig. 4.10–4.12. Elementary, math/science, and special education teachers all show the basic pattern. However, the average levels and patterns of attrition differed greatly enough that large errors could be made in projecting new teacher demand if specialty-specific rates were not used.

The above discussion has highlighted the importance of disaggregating teacher attrition rates by age, sex, and specialty. These analyses are preliminary and need more advanced statistical methods before models that can serve as the basis of projections are developed.

TIME-SERIES EVIDENCE FROM FOUR STATES

Has the level of teacher attrition/mobility changed over the last 25 years? Some consistent evidence is available from four states that indicates a marked decline in teacher attrition/mobility rates during this period, and that today's level of attrition/mobility is the lowest in the last 25 years.

Our search of available published state data uncovered four states—Illinois, Michigan, New York, and Utah—that seem to use historically consistent definitions of teacher attrition/mobility and publish time-series comparisons of these data. In each state attrition is defined to include a teacher who taught in the state during one year and not in the following year. The definition includes both temporary and permanent attrition from teaching within the state and individuals moving to another state who may or may not teach. The definition also includes both voluntary and involuntary attrition.

In each state the level of attrition/mobility shows a dramatic downward trend from the 1960s and 1970s to the 1980s, but the data also show a fair amount of year-to-year perturbation around the trend (see Tables 4.1, 4.2, 4.3, and 4.4). Utah has the longest time-series and attrition/mobility rates have declined from peak values of 11–13

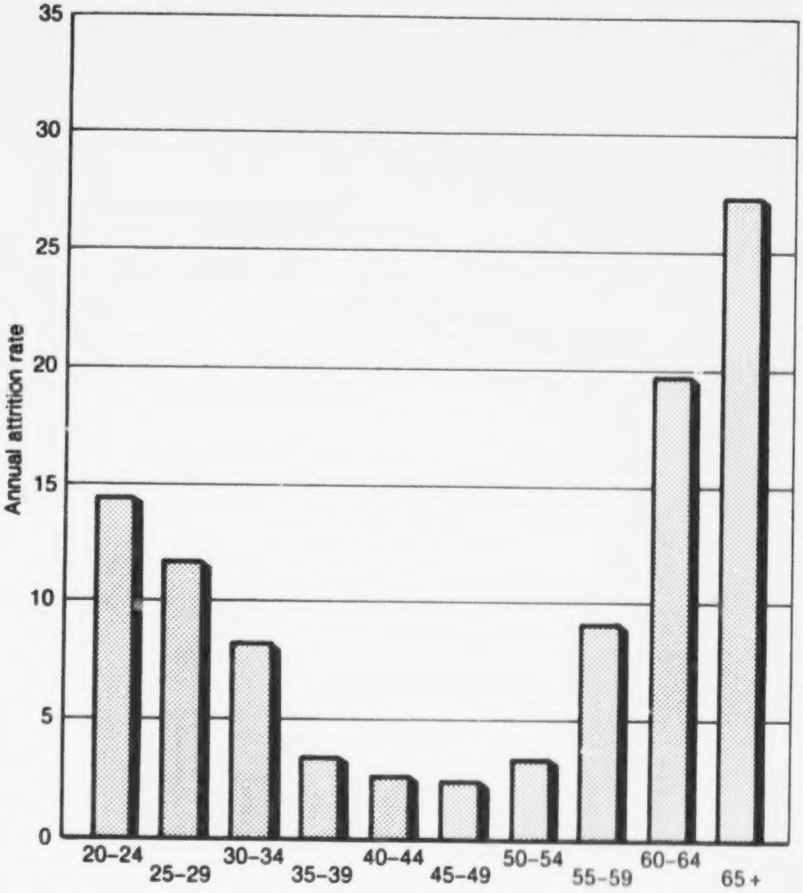

Fig. 4.9—Attrition rate of total teachers, by age group

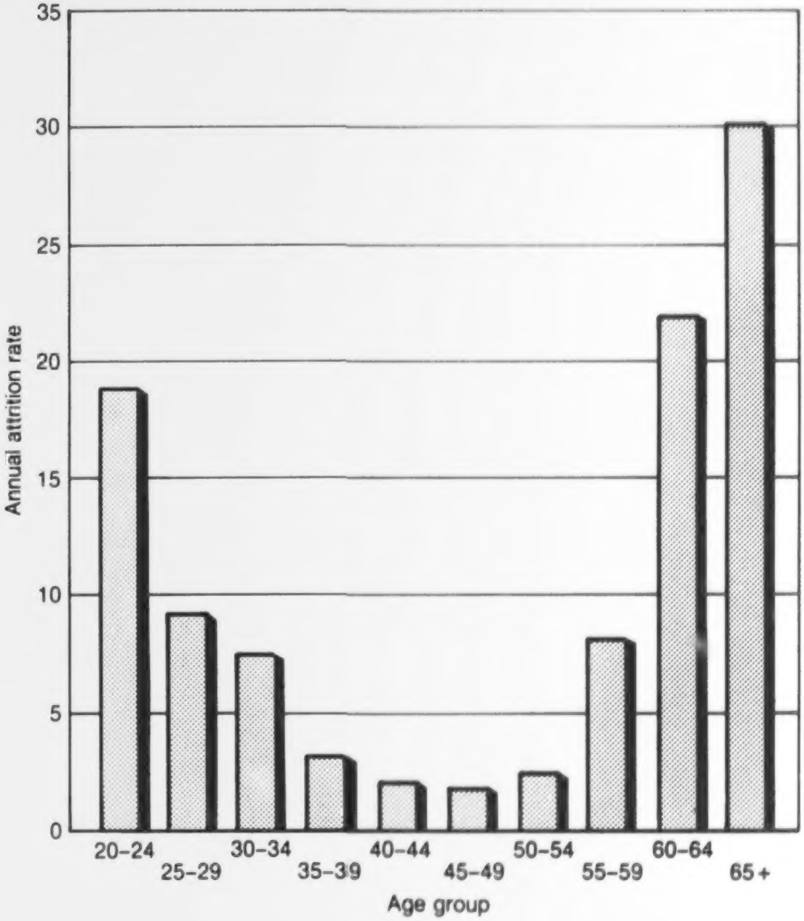

Fig. 4.10—Attrition rate of elementary school teachers, by age group

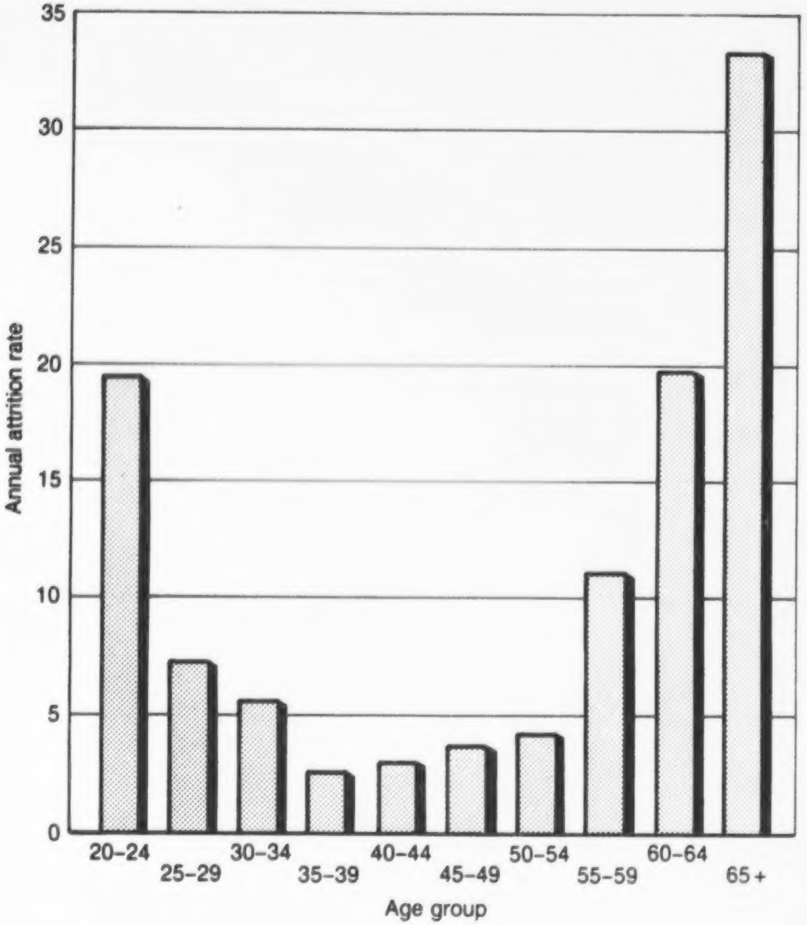

Fig. 4.11—Attrition rate of math/science teachers, by age group

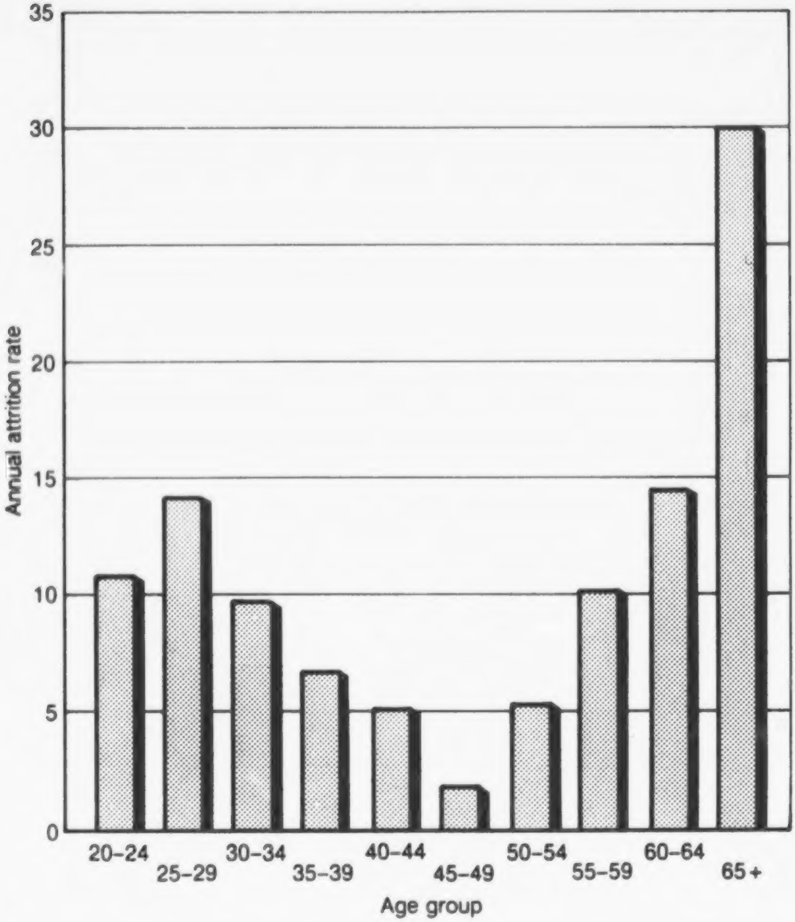

Fig. 4.12—Attrition rate of special education teachers, by age group

Table 4.1

PERCENTAGE OF TEACHER TURNOVER IN ILLINOIS

Year	Downstate Rate	Chicago Rate
1969–70	13.8	12.8
1970–71	12.2	10.3
1971–72	11.6	8.1
1972–73	11.1	11.2
1973–74	10.1	11.6
1974–75	8.7	13.4
1975–76	10.1	11.9
1976–77	9.7	9.0
1977–78	9.4	9.6
1978–79	9.7	11.0
1979–80	8.3	6.1
1980–81	8.1	4.0
1981–82	7.1	5.7
1982–83	7.3	4.4
1983–84	6.5	5.6

Table 4.2

PERCENTAGE OF TEACHER TURNOVÈR IN MICHIGAN

Year	Rate
1972–73	11.2
1973–74	9.5
1974–75	8.4
1975–76	8.5
1976–77	7.9
1977–78	7.5
1978–79	7.8
1979–80	7.9

SOURCE: Michigan Department of Education (1981), p. 33.

percent in the 1960s to 5–6 percent in the 1980s. New York has comparisons for four years only and attrition/mobility has declined from around 16 to 9 percent between 1967–1968 and 1983–1984. New York also publishes data by types of teachers and the trends are consistent for elementary and secondary school teachers (as well as for several teacher specialties not shown here). Illinois shows declines from peak

Table 4.3

PERCENTAGE OF TEACHER TURNOVER IN UTAH

Year	Rate
1963	11.49
1964	8.97
1965	8.86
1966	9.86
1967	11.32
1968	12.89
1969	13.33
1970	12.62
1971	8.13
1972	10.94
1973	9.52
1974	6.65
1975	7.85
1976	8.03
1977	6.26
1978	7.60
1979	8.30

Table 4.4

PERCENTAGE OF TEACHER TURNOVER IN NEW YORK STATE PUBLIC SCHOOLS

Type of Teacher	1967-68	1974-75	1981-82	1983-84
Total	16.5	12.8	9.1	9.2
Elementary	17.2	13.0	8.9	8.8
Secondary	15.9	12.2	8.7	9.0

attrition/mobility rates in Chicago schools of 13 percent in the early to mid 1970s to 4-6 percent in the 1980s. For downstate schools the declines are from 13-14 percent to the 6-8 percent level. Finally, for Michigan a much shorter history shows declines from 11 percent in 1972-1973 to 7-8 percent in 1979-1980.

It would be unwarranted to generalize from these data without a more detailed analysis of the unique factors contributing to attrition in each state and analysis of data from other states. However, the trends noted would be easily predictable from the different strands of the theory of teacher attrition/mobility. The easiest factor to identify is the attrition differences that would be expected from the demographic shifts within the teaching profession during this time period. During the 1960s and early 1970s, a higher proportion of teachers were young and inexperienced—and subject to higher levels of attrition/mobility. This younger force resulted from the strong demand for new teachers caused by the baby boom of the 1960s and early 1970s. This relatively young, inexperienced teaching force has become by the 1980s a predominantly stable, mid-career teaching force. This transition can cause relatively large shifts in overall attrition/mobility levels, since early attrition/mobility is typically a factor of 5 to 10 times higher than mid-career levels. However, this demographic shift can explain only a portion of the shift to lower attrition/mobility.

Attrition/mobility levels probably have declined not only because a greater proportion of teachers are in the stable mid-career phase, but also because attrition rates for each age group may have declined. Some evidence for this exists from New York State, which publishes attrition/mobility rates over time by age group (see Table 4.5). These data show the usual higher attrition/mobility for younger and older age groups for each time period. However, they also show declines over time in attrition/mobility levels for each age group up to retirement eligible groups where they show an increase over time. These trends by age group point to structural factors within the teaching profession or the teaching labor market that have resulted in higher long-term retention rates.

Higher structural retention rates for preretirement teachers might be explained by a combination of the following factors:

Table 4.5

PERCENTAGE OF TEACHER TURNOVER IN NEW YORK STATE PUBLIC SCHOOLS, BY AGE

Age	1967-68	1974-75	1981-82	1983-84
< 35	21.8	15.8	11.3	11.4
35-39	10.1	7.4	6.1	6.4
40-44	8.7	6.5	5.4	5.7
45-49	7.9	6.5	5.2	5.3
50-54	8.7	8.4	7.8	7.9
55-59	11.3	13.6	14.6	16.5
60+	24.0	30.2	27.1	29.8

- Selection of individuals into teaching who are more likely to stay longer or the increased educational investment made by these individuals that predisposes them to stay longer;
- Reluctance to leave teaching—especially for short periods—because of a higher risk of not obtaining reemployment in teaching;
- Less opportunity for mobility or promotion within the profession;
- Higher real levels of pay and benefits/improved teaching conditions;
- Strengthening of teacher unions and procedures for dismissals of teaching (which may be a minor factor); and
- Tighter nonteaching job markets.

A major structural factor that has changed from the 1960s and early 1970s to the present is the tightness of the teacher labor market. Individuals and employing institutions behave differently in a labor market characterized by rapid growth in a profession than one characterized by stable or contracting size. This different behavior stems from several factors—most of which act to lower attrition/mobility rates.

The characteristics of the "average" individual entering the profession change when demand for new teachers is high rather than low. Other things equal, a high demand for new teachers—conditions of the 1960s—encourages individuals at the margin who have less "taste" or commitment for teaching to choose the profession. Individuals who chose teaching in the baby boom era were more easily attracted into teaching because of the ready availability of jobs and probably made less informed—and more easily reversed—decisions about the suitability of teaching for them.

At the same time school districts are probably less discriminating and have to be less selective in hiring during times of high new teacher demand. Greater selectivity can mean hiring more experienced teachers rather than new college graduates, or choosing individuals displaying characteristics associated with longevity and commitment to the profession.[1] As demand for new teachers grows, school districts must reach deeper into the pool of applicants, which usually means accepting teachers with less desirable characteristics.

There has been an additional change in the pool of entering teachers in the 1980s which would lead to lower attrition. This change is the greater proportion of entering teachers with either previous teaching experience or previous work experience outside the profession. Both of these characteristics lead to lower early attrition. Two conditions created this pool of more experienced individuals. A surplus of education majors unable to get teaching jobs occurred in the 1970s as the demand for new teachers declined rapidly. Some of these individuals took other jobs and waited to enter teaching until opportunities were present. At the same time, reductions in force were occurring in some areas, creating a pool of teachers with experience who would later reenter teaching. The presence of these pools in the 1980s means less dependence on the more attrition-prone new college graduates.

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[1] Wise et al. (1987), in fact, found that it is the persistent applicants (who may have the strongest commitment to teaching) who tend to get hired.

For these reasons it is likely that the new teachers hired in the 1980s are more highly qualified and more experienced than those selected in the 1960s and early 1970s. This kind of selectivity would primarily affect early attrition/mobility of teachers. Poorer teachers would be replaced early in their career and those who found teaching not to their liking would likely leave in the first five years of teaching.

Another factor driving high attrition/mobility in times of growth in the profession is the ease of movement among teaching jobs. Decisions to move between schools, districts, and states is less risky when jobs are readily available than in tighter labor markets. It is also easier to stop teaching to return to school, raise children, or try another job knowing that teaching jobs will be available if one decides to return. Reductions in force in the late 1970s and 1980s reinforced the risk associated with leaving teaching jobs. These risks may have been tempered somewhat by changing teacher union contracts, which may have insured re-employment rights after leaves of absence.

Real changes in teacher pay, benefits, and working conditions with respect to closely competing occupations would result in increased teacher retention. From an economic perspective, higher demand for new teachers should bring higher salaries and nonpecuniary benefits if one wishes to maintain similar levels of teacher quality. One would argue that school boards would respond to higher demand and the threat of shortage with salary increases to stay competitive with other occupations and other school districts. Another factor pointing to lower attrition is the change in one key working condition—class size. Class sizes have declined from the 1960s to the 1980s.

The influence of teacher unions and changing teacher contracts may have an influence on teacher attrition rates. Two areas of union activity might influence teacher attrition/mobility in different directions. Strengthening rules concerning dismissals of teachers could reduce attrition levels. On the other hand, stronger re-employment rights of teachers on leaves of absence may have made it easier to leave for an extended period of time and increase teacher attrition. Whether these kinds of changes have occurred is not well documented.

A final influence on attrition would be changes in the retirement systems. The structure of teacher retirement systems can influence attrition strongly. This influence is one factor that makes teacher attrition rates so low and stable during the mid- to late-career group, and raising benefit levels can decrease these attrition levels. The key features of the retirement system that lower teacher attrition levels include the lack of portability of retirement benefits, the number of years to vesting, and the minimum years for retirement eligibility. Research in another occupation (Gotz and McCall, 1984) that has a retirement system with some similar features has shown that retirement system influence becomes a dominant factor in attrition rates for mid- and late-career personnel.

The structure of the retirement system not only influences teacher attrition before retirement eligibility but also strongly influences the timing of retirement. The timing of retirement is particularly sensitive to policies concerning early retirement. In New York there seems to be a shift toward higher attrition and more early retirement for retirement-eligible personnel over the period from 1967 to 1983. This shift might be caused by the more liberal early retirement policies that many school systems adopted to temper teacher layoffs during the surplus of the 1970s.

V. IMPROVING THE QUALITY OF DATA ON TEACHER ATTRITION

This last section is organized around three key issues:

- The analytic and policy usefulness of a better understanding of attrition and improved attrition estimates.
- Currently available data useful for studying attrition.
- Strategies for improving attrition estimates.

ANALYTIC AND POLICY USEFULNESS OF BETTER ATTRITION ESTIMATES

Three of the major challenges facing educational policymakers in the next 15 years are:

- Expanding the teacher workforce to meet higher enrollments and quality education goals.
- Improving the quality of the teaching force.
- Achieving an efficient and cost-effective teacher workforce during an era of rapidly increasing educational costs and limited fiscal capacity.

An expansion of the teaching force—first at the elementary school level and then at the junior and senior high school levels—will be required if the increased enrollments are to be absorbed without increasing class sizes. This expansion alone will mean increases in education budgets. A second source of increased costs will be the increases in teacher salaries needed to recruit and retain these teachers. If present teacher labor markets are in equilibrium, salary increases would be needed just to maintain teacher quality during a period of expansion and increased demand for new teachers.

The final goal of improving the quality of the workforce will be extraordinarily difficult during this period. The quality and productivity of a workforce usually falls during a period of expansion, partly because higher demand usually means less selectivity in hiring, and therefore lower quality incoming teachers. A second reason is that during a period of high demand, there is a tendency to keep the marginal worker to meet expansion objectives. A third reason is that increased hiring usually means a younger and less experienced workforce. Yet a fourth reason is that organizational resources and teacher time usually devoted to productivity improving activities tend to be absorbed by the simple demands from expansion.

These natural tendencies toward lower quality during expansion could be countered by additional salary increases or resources devoted to productivity improving activities. However, these resources would be above those required to pay for recruiting and retaining the expanded workforce. As such it represents a third increment to educational budgets if it is to be achieved.

A particular problem in improving the teacher workforce is the simple demographics of this workforce. Two major groups of teachers will constitute an increasing share of teachers in the next 15 years—younger and older teachers. Both groups pose special problems. Other things equal, younger teachers face a steep learning curve during their first years of teaching and probably do not reach peak productivity until after several years of teaching experience. This learning curve means that a greater proportion of younger teachers—other things equal—will lead to lower average teacher quality. Another factor that causes younger teachers to be less productive is their greater mobility. Entry into and out of the profession and changes in schools and school districts all require some initial adjustment and learning.

After teachers reach peak productivity—probably after about 10–15 years of teaching—further gains in productivity are likely to be small. Thus, although the present predominantly mid-career teaching force represents a very productive force, further gains in quality and productivity are not likely as this force moves toward late career.

In a budget constrained environment where simple enrollment expansion is likely to take budget priority, it is probably unlikely that sufficient budgetary resources will be available to pay more teachers and to pay the higher salaries required to both expand the workforce and to improve its quality. If these resources are not available, one hope for achieving better teacher quality is through better understanding and management of the teacher workforce. This includes teacher recruitment and selection and management of the teacher attrition process so that better teachers stay longer and poorer teachers improve or leave. Understanding attrition decisions is an important part of this process.

Broadly defined, we can identify three areas (not altogether mutually exclusive) where reliable, consistent attrition estimates and better understanding of teacher attrition and mobility would be important. They are:

- Improving estimates of teacher supply and demand.
- Identifying and evaluating policies and conditions that are effective in both attracting and retaining better teachers.
- Understanding how attrition affects the productivity and costs of the teaching force.

Better understanding can answer the following kinds of questions:

- What factors affect teacher attrition rates?
- What will be the future course of teacher mobility and attrition rates?
- How sensitive are shortage estimates to inaccurate attrition estimates?
- How much could reduced attrition lower the number of new teachers who need to be hired during this period of expansion?
- How much do mobility and attrition rates vary across states and districts?
- Will differing mobility/attrition rates play a strong role in determining where shortages occur?
- Are leaving teachers of higher or lower quality?
- What policies can reduce attrition of better teachers?
- What policies can increase attrition of poorer teachers?
- How should new teachers be selected to decrease early attrition among new, better quality teachers?
- How does the structure of the salary and promotion system contribute to teacher attrition patterns?
- What are the costs when better teachers leave teaching?

ATTRITION ESTIMATES IN SUPPLY AND DEMAND MODELING

Attrition estimates need to fit the requirements of well designed supply/demand models. Before we can define the needed attrition estimates, we need to discuss how teacher supply/demand models should be designed.

THE DESIGN OF TEACHER SUPPLY/DEMAND MODELS

Two limitations of current teacher supply/demand models considerably impair the credibility and policy usefulness of such models. The first concerns the treatment of behavioral, policy, and competitive effects within the model, and the second concerns the assumptions about the extent of teacher labor markets and substitution among different types of teachers. The first can be characterized as a problem in model complexity, and the second a problem in model aggregation.

Three levels of increasingly complex teacher supply/demand models can be identified that could aid in policymaking during the coming expansion of the teacher labor force. The three types of models are:

- Simple, static models that assume no behavioral or policy responsiveness on the part of teachers, potential teachers, school districts, or states;
- Dynamic models that include responsiveness of teachers, potential teachers, school districts, and states to changing labor market conditions; and
- Dynamic, competitive models that attempt to recognize competitive effects among states and districts for teachers.

Each of these is useful under different conditions, which we delineate below.

A useful place to begin is to briefly summarize current static models to see their strengths and weaknesses. Simple static models would account for teacher attrition, enrollment growth, and student/teachers ratios on the demand side, and the several sources of supply (new graduates, transfers, and the reserve pool) on the supply side. The model would link the supply and demand side so that incoming teachers are fit into the inventory and become part of future attrition and demand calculations (see Prowda and Grissmer, 1986). Such models can be built for any teacher group but to have any credibility should disaggregate teachers into behaviorally sensitive groups. This should include—at a minimum—disaggregation by age or experience and by sex.

The models are referred to as static because most key parameters in them do not change with time. We usually assume that things like attrition rates, sources of supply, and student/teacher ratios take on recent values or simple extrapolations from past trends. Little effort is made to develop behavioral models of these key parameters that could be projected into the future. Such models also do not account for policy changes such as competency tests, or salary increases, or changes in the retirement system.

Current teacher supply/demand models—even adequate static models that correctly incorporate the important static elements with proper disaggregation—have not been developed at either the national or the state level. Common shortcomings of current static models include:

- Assuming that newly graduated education majors are the primary or sole source of new supply (no reserve pool, no transfers);
- Assuming that only in-state education majors are important sources of supply within a state;
- Assuming that all new education majors will teach;
- Failing to include mobile teachers from other states in supply calculations;
- Assuming that teacher attrition rates will stay constant and not be sensitive to the current characteristics of the teaching force;
- Failing to separate voluntary from involuntary attrition (and the effects of reductions in teachers) in historical data when estimating a future constant attrition rate;
- Failing to recognize the dependence of class size on enrollment growth and new teacher demand;
- In some cases, failing to incorporate the coming enrollment increases resulting from the baby boomlet;
- Failing in some instances to separate and correctly incorporate enrollment increases from migration with internal enrollment growth resulting from fertility trends; and
- Failing to recognize historical demand constraints on new teacher supply when projecting future supply flows.

Each of the state and national models reviewed contained several of the shortcomings cited above. The shortcomings are mainly due to three factors: a lack of adequate data from which to estimate parameters, lack of resources to derive estimates, and lack of technical expertise to design integrated supply and demand models.

However, even well-designed and properly integrated static models could not be expected to produce accurate projections of the future teacher labor market because these models do not consider the behavioral and institutional changes likely to occur in the teacher labor market as a result of its competitive nature. As such, they fail to include:

- The increases in teacher salaries that will be triggered by the increased demand for teachers and the natural competitiveness between school districts;
- The different responsiveness and potential lags among the diverse set of school boards and districts in raising salaries;
- The labor market responsiveness of critical supply groups to shortages and changes in salaries and nonpecuniary benefits. These groups whose responsiveness will be critical are:

    - Present teachers choosing when and whether to leave teaching;
    - College students choosing majors;
    - Education major graduates choosing first and subsequent jobs;
    - The large baby boom pool of college graduate women who will be returning to the labor force in the next 15 years; and
    - The increasing pool of early retirees looking for second career opportunities.
- The effects of increasing barriers to entering to teaching caused by the push for improved teacher quality;
- The policy flexibility of school districts to reduce demand for teachers through larger classes, reduced course offerings, and consolidation of schools;
- The policy flexibility of states and districts to increase the supply of teachers through enhanced recruiting effort, scholarships, and emergency certification;
- The choice of individuals about where to teach when several choices are available; and
- Future increased mobility among present teachers when more teaching jobs are available.

We argue, however, that soundly designed static models are a starting point for incorporating more complex behavioral and competitive effects. Static models are useful if they can point out consequences and shortages if no action is taken. However, people and institutions will react to potential shortages and problems, and it is these reactions that will chiefly determine the extent and location of teacher shortages or surplus. Models not incorporating these effects thus will not be entirely credible. What makes these models even less useful in our context is the fact that the next 15 years promises to be a rather volatile period, when significant changes in key supply/demand factors can be expected to dominate the teaching labor market.

Besides failing to incorporate behavioral and policy effects in models, a second major shortcoming impedes the usefulness of such models.

TEACHER SUPPLY/DEMAND MODEL AGGREGATION

Two questions about aggregation need to be answered before appropriate policy-oriented models can be developed. The first question involves the types of teachers who should be combined into the same model. The second question concerns the geographical extent of the labor markets for teachers. Current models are generally not developed at the appropriate level of disaggregation that recognizes realistic substitution possibilities among teachers and the boundaries of teacher labor markets.

Within the confines of a single integrated supply/demand model, the usual assumption is that any teacher added to supply can satisfy any part of the demand. Thus, a national model that includes all types of teachers would contain the assumption that high school Spanish teachers could satisfy the demand for elementary school teachers. In economic terms, teachers are assumed to be perfect substitutes. In reality substitution across levels and types of teachers is very imperfect, and supply/demand models should be constructed separately for teacher groups that form close substitutes. This means—at a minimum—separate models for elementary, special education, and several different types of junior and senior high school teachers. These latter groups would include mathematics, the various sciences, business, trade, English, social science, etc.

Substitution possibilities dictate the types of teachers who are included within a single model. A second type of disaggregation decision is needed for demographic groups within the same model. This type of disaggregation is necessary because different groups will have different attrition patterns and different responsiveness to salary and other programs. Male and female elementary school teachers will have different attrition patterns because they leave for different reasons. So within an elementary school supply/demand model, male and female groups should be separated and allowed to have different attrition and salary response patterns. This disaggregation of teacher types into groups having fairly homogeneous economic responses will improve the accuracy of such models.

A second assumption contained in national models is that a national labor market exists for teachers. Actual teacher labor markets are difficult to precisely define, but the defining principle is easy to articulate. A labor market is defined as the group of employers who would be affected by wage increases instituted by another employer. If one school district raises wages, and the supply of individuals to all other school districts is unaffected, then that school district would constitute an independent labor market. If, at the other extreme, raising wages in any district triggered decreases in supply in all other school districts in the nation, such that each would have to raise wages to maintain their supply of teachers, then a national market would exist for teachers.

A national labor market can exist even though every individual would not be equally willing to teach anywhere in the country. We know for instance that there are strong revealed preferences for teaching in areas in which one has previously lived, as well as teaching within the same state as one has lived or gone to college. These strong preferences do not rule out the existence of a national labor market. Wage offers can be correlated between districts and states provided that enough—perhaps very few—people at the margin decide to move or accept different offers. Most teachers can be immune to different offers—probably because of location-specific human capital, retirement vesting, or preference for home location—and effective interstate and intrastate labor markets can still operate.

It is probably the case that effective labor markets exist within states—notwithstanding the urban-rural differences, and that neighboring states are more strongly coupled than widely separated states. It is also probably the case that a loosely coupled—and slowly responsive—national labor market does exist. In the short run, raising salaries in some states may not strongly affect supply in distant states, but in the long run a kind of domino effect through neighboring states can reach and affect distant states. This national labor market may tend to become more strongly coupled in times of stronger demand for new teachers when districts widen their recruiting search for new teachers.

What kinds of teacher supply/demand models should be built? A national supply/demand model that includes all teacher types makes little sense and can be quite misleading in its implications for shortages. It is particularly hazardous now when opposing enrollment trends are present in elementary and secondary schools. Such models assume that surplus high school teachers could fill the new demand for elementary school teachers. The only models that make any sense at the national level are ones for teacher groups that form close substitutes. Even these models must be interpreted very cautiously. In general these models will tend to overestimate available teacher supply, since they assume that teachers will flow to the geographical area of the demand.

Because strong national teacher labor markets probably do not exist, national models must separate state or city components to produce credible projections for several reasons. First, such segmentation could begin to address the problem of weakly coupled labor markets. Second, the important policy parameters that can change supply and demand exist at the state and local level and changes will be occurring differently by state and district. Third, key supply and demand parameters differ markedly among states and districts. These include the pace of enrollment changes, attrition rates, sources of supply, and many others. Fourth, national models should be able to predict the geographical and urban/rural dimension of shortages. This is possible only if national models have state and city components—at least for the major states and cities where most of the demand occurs.

ATTRITION DATA NEEDED TO SUPPORT TEACHER SUPPLY/DEMAND MODELS

Teacher supply/demand models need to be disaggregated by state or city; further, each such model needs disaggregation by age or experience and sex. Teacher attrition rates need to be similarly disaggregated. In addition the supply/demand models need projections of future values dependent on various policy and economic conditions.

There are currently two major opportunities for improving attrition estimates—a national survey of teachers with a follow-up of separating teachers[1] and the more intensive use of existing computerized state teacher files. The two data sources are generally complementary. Each offers opportunities to fill major gaps in our understanding of attrition and to improve supply/demand models in a unique way; they are discussed below.

State Data Files

One data source for improved attrition estimates is state personnel teacher files. These files are kept by most states and are an important resource for improving our knowledge and ability to predict attrition. Matching year-to-year files can determine which teachers stay and which leave teaching in the state. They can also determine interdistrict mobility. Most files have an abundance of demographic characteristics that can be used as independent variables in attrition models. If demographic variables are the most important determinants of attrition, then these models can be expected to generate fairly accurate attrition forecasts.

Many states have teacher certification and teacher census files that extend back for as long as 20 years. Such files can provide the data to analyze cohorts of entering teachers over a fairly long time period. Not only can such data look at questions concerning who leaves and who stays, but also at the leaving and reentering patterns of teachers. Such information as the length of the period of separation, the age at separation and reentry, and the difference in patterns across types of teachers and demographic groups would be of interest. These types of questions can be addressed with survivor analysis (Cox and Oates, 1984; Elandt-Johnson and Johnson, 1980; Kalbfleisch and Prentice, 1980).

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[1] Such a survey by the Center for Education Statistics is planned for 1988 with follow-up of a subsample of teachers in 1989.

One prerequisite for this type of analysis is the ability to link records across years through matching Social Security numbers. Such data have to be very accurate; inaccurate recording of Social Security numbers can incorrectly make some teachers look like leaving teachers. The proportion of such teachers improperly identified must be very small, to enable a relatively unbiased analysis to take place. Because most state records have not been linked in this way, the quality of such data should be explored before deciding whether and how much cost should be incurred in their analysis. One approach is to gather a limited sample of data from a few different states to explore the question of data quality.

These files can also be supplemented by local district data on economic conditions and various characteristics of the school system and pupils to generate improved predictors of attrition rates. One rich source of such data is the U.S. Census STF-3F tape, which provides Census of Population data mapped to school district boundaries. Some states even keep causes of attrition so that voluntary and involuntary attrition can be separated, as well as the status of the teacher in the following year. These files have a decided advantage over survey data in that they contain the total universe of teachers within a state. As such they would be able to support obtaining attrition rates for highly disaggregated groups of teachers (male math teachers under age 30, for example). The national survey will be unable to provide state estimates for subgroups of teachers.

The larger sample size will also allow much more finely tuned models of attrition to be developed. These models can contain several state- and county-specific variables and represent the best chance of measuring the impact on attrition of such factors as pay, urban/rural locations, demographics, and economic conditions.

There are two major disadvantages of state data. These data will not be able to support multiple definitions of attrition. State data do not contain the teaching status of a leaving teacher in the following year if that teacher moved out of state. State data will only tell whether a teacher who taught one year is not teaching in the following year; we will not know the reason for not teaching. National survey data will be better able to separate attrition into its various components.

A second disadvantage of state data is that only data elements collected by the states and those that can be attached at the county level are present for analysis. Survey data can yield a potentially much richer set of variables for analysis. The ideal circumstance would be for states to field surveys that can be attached to the teacher files. If a common survey could be fielded by several states this could provide perhaps the best source of data for attrition analysis.

Many states have such files dating back for 10 to 15 years. Thus historical attrition rates can be reconstructed in many cases. These data could then be used to support time-series/cross-sectional models of teacher attrition over many years. They could then become the basis for projecting future attrition rates in supply/demand models.

Data to begin development of such models currently exist for almost all large states and many smaller states and some major school districts. Adequate data to begin these efforts do exist at the state level, but a major effort would be needed to centralize such data at a national level.

Another approach to obtaining the kinds of national models desired is to first develop state-specific models. These state models could contain some segmentation by urban/suburban/rural location and would allow eventual linking of state models into national models. Because the states generally are the repositories of the key data needed for such models, an effort that develops prototype state models with an eventual eye to inclusion in national models could work. The first step would be to work with a small group of states to develop a prototype model that would define the data requirements and structure of such models. Other states could then be trained in the model and its use would generate the needed data for the eventual national model. The environment for such an effort is favorable, since all states are concerned about the supply of teachers, and current modeling efforts at the state level are inadequate.

Attrition Data from National Surveys

At present, no reliable data or analyses exist on teacher attrition at the national level. As we said above, NCES projections have used a constant 6 percent teacher attrition factor; this figure dates back to data collected in 1969. Although some state analyses exist, no systematic attempt has been made to understand or analyze national attrition patterns.

Existing national data sources with some potential to study teacher attrition include the March Current Population Survey (CPS), the NCES Survey of College Graduates, the National Longitudinal Survey, and High School and Beyond). Unfortunately, these surveys have limited usefulness because of relatively small teacher sample sizes, definitional problems in defining types of teachers, or the lack of important variables needed in teacher attrition models.

The CPS, for example, is a stratified random sample of about 56,000 U.S. households; the May survey contains information on wages and other occupational characteristics. Although the CPS has some limited longitudinal properties, the sample sizes and the lack of detailed job-specific information make it of limited usefulness for our purposes. However, two national data sources have large sample sizes of teachers and particular advantages in studying teacher attrition. They are the Census and the Social Security File.

One data source that was used successfully in the past (Keeler, 1973) but has not been used recently is the Social Security longitudinal 1 percent file. Each year since 1957, the Social Security Administration has generated a national 1 percent sample of covered wage earners by selecting the records of individuals possessing certain combinations of digits in their Social Security numbers. Sampling of the same combination of digits year after year has assured continuity of the file—that is, retention of the same individuals in the sample as long as they continue to earn income covered by the system. The file is divided into two sections: employee-generated and employer-generated data. The employee's date of birth, race, and sex are obtained from forms filled out when he or she first applied for a Social Security number and from correction notices received subsequently by the Social Security Administration. Data on employers include industry, size, quarterly withholdings, county of employment, and so forth. The file has a very large sample and allows for tracking an individual's jobs and earnings longitudinally. As such, it would be able to follow the job patterns of teachers both before entering teaching and after leaving teaching. NCES should evaluate this file for possible development of national attrition estimates.

The 1970 Census data were used (Sweet and Jacobsen, 1982) to examine teacher attrition outside the profession. The 1980 Census file has not been used to do a similar analysis. Such an analysis would be limited in its usefulness because it would cover attrition from 1975 to 1980—a period of retrenchment in the teaching profession. Therefore, its applicability to future patterns of attrition may be limited.

Design Considerations in New Attrition Data Collection

The most important source of national information on attrition could be the planned NCES national survey of teachers that is scheduled to have a longitudinal element for attriting teachers. This survey has been proposed by NCES as one component of the overall set of surveys currently being developed (or redesigned) to answer a comprehensive set of questions concerning teachers and education. For a number of analytic purposes, longitudinal surveys of teachers—whether at the national or at the state level—are important.

One possible design for a set of teacher surveys to illuminate questions of attrition would consist of (a) an exit (or as soon thereafter as possible) interview and (b) three follow-up interviews, two years apart.

To be most useful for attrition analysis, we suggest three ideas for inclusion in the basic design of longitudinal teacher surveys. The three design features are:

- Create a separable sample of entering teachers in the year of the survey.
- Include all these entering teachers in the longitudinal element of the teacher survey.
- Include a random sample of both teachers who continue and teachers who leave in the longitudinal element of the survey.

The basic survey would then be a base year "representative" sample of teachers primarily for the purpose of characterizing and monitoring the national teaching force. A second supplemental sample of entering teachers would be drawn and three groups of teachers would be longitudinally monitored—all leaving teachers from the "representative" sample, a small random sample of teachers who stay from the "representative" sample, and the entire sample of entering teachers.

The argument for drawing and following entering teachers revolves around the following propositions:

- Finding ways of increasing teacher supply and retaining young teachers will be critical policy problems in the next 15 years.
- The best and only unbiased information for studying teacher supply and early attrition of teachers in the entire survey will come from teachers entering in the year of the survey.
- The sample size of entering teachers that would occur in a "representative" sample might be too small for many analyses partly because of the heterogeneity of entering teachers.
- A supplemental sample could significantly enhance the information available to study both attrition and sources of new supply.

One major supply/demand problem in the next 15 years will be meeting the staffing requirements of increased enrollments. These increased staffing requirements can be met through increasing the supply of entering teachers or extending the longevity of teachers currently teaching or those who will enter the teaching force. The major issue concerning longevity is early attrition of teachers, since mid-career teachers have fairly predictable and very low attrition. Supply and early attrition are also areas where major gaps in knowledge currently exist.

In determining the future supply of teachers, the major gap in current knowledge concerns the reserve pool. Only about one-third to one-half of entering teachers seem to come from the traditional—and well studied—source of new college graduates (Cavin, 1986). Data are currently collected by NCES and several states concerning the future supply of teachers from this pool. We currently have little information concerning why the remaining one-half to two-thirds enter teaching, and where they come from.

Teacher surveys will be the principal sources of data for studying alternative sources of teachers and there will be much demand for analysis concerned with expanding the supply from these sources. Indications are that there are several behaviorally distinct "reserve pools." These include at a district or state level individuals who simply move from one district or state to another, move between public and private schools, enter teaching from another job or from a substitute teaching status, or enter teaching from a nonworking status. In each of these cases, one would want to know motivations and barriers to reentry to teaching by demographic and other characteristics.

For projecting future supply one needs to know whether these pools will expand and whether the propensity to enter teaching from each pool will change. In particular, one will want to study the role that various hiring policies and other reentry barriers might play in delaying a return to teaching.

Tracking leaving teachers through surveys can also help improve estimates of the reserve pool and the propensity of various parts of the reserve pool to return to teaching. Teachers leaving one area to look for or accept teaching positions elsewhere obviously become either part of the actual supply or part of the reserve pool for that area. Teachers who leave teaching for nonteaching occupations (including homemaking or childrearing) clearly form the bulk of the reserve pool. The importance of obtaining better counts of both mobile and attriting teachers in modeling supply should be clear.

Although one can use information about source of entry from experienced teachers who did not enter teaching in the year of the survey, such teachers have a self-selection bias. They may not be representative of all teachers who currently enter teaching. For instance, the current set of fourth-year teachers might be asked what they did in the year before they started teaching. For two reasons this information may not be an accurate guide to inferring what all current teachers do the year before they start teaching. First, entry times are different and the prior activities of entering teachers may change over time. Second, many teachers who entered in the cohort of current fourth-year teachers have left in the first three years, and these teachers may have different prior activities than those remaining. Thus, the best data to guide future policy will come through collecting supply data and following attrition from the entering cohort in the survey year.

A simple random sample of teachers would include entering teachers only in proportion to their natural proportion in the teacher population. Depending on how this group is defined (entering from another school, district, state, or nonteaching status) this proportion could be as low as 4 percent or as high as 20 percent. If we limit attention here to teachers who at least cross district lines when they leave and to all who return to teaching from other status, the proportion of entering teachers would be around 4–9 percent. Thus, for example, in a sample of 40,000 teachers, we would obtain around 1,600 to 3,600 such entering teachers.

This may seem a robust sample until one remembers both nonresponse and that entering teachers are quite heterogeneous. First-year graduates may constitute around 40 percent, which gives 640 to 1,440 potential responses. One might want to compare in-state with out-of-state first-year teachers. Each of these groups would have even smaller samples. The non-first-year graduate sources of entering teachers are also fairly heterogeneous and one would like to study each behaviorally distinct group in some detail (reasons for entry by demographics, family status, and previous labor force status, etc.). In such cases sample sizes could easily number less than 100 without special stratification.

It seems to be especially important to be able to assess some measure of quality from each source. What are the best sources for entering teachers? One interesting subgroup for quality considerations will be entering teachers who hold emergency certification. This subgroup will perhaps provide some insight into a phenomenon that will probably increase as teacher demand increases. As soon as we begin to differentiate this group of entering teachers, the sample size shrinks to the low hundreds—which may be inadequate for simple univariate analyses or for complex multivariate models, especially when we take nonresponse into account.

This sample of entering teachers will also be our only unbiased source for studying early attrition. The early attrition problem will take on added importance as more young teachers are hired to meet increased enrollments. Attrition rates for young teachers can run as high as 10 times those for mid-career teachers. In addition, early attrition is probably more susceptible to policy intervention than mid-career attrition. If ways can be found to retain more teachers in their early years, then the number that will have to be hired can be considerably reduced.

Special sampling of entering teachers together with longitudinal tracking could provide an unusual opportunity to discover differences between leaving and staying teachers. Needless to say, a larger sample size would be able to distinguish these differences in greater detail. The value of the larger sample size depends on the degree of heterogeneity between the entering group and those who leave. Many leave to teach elsewhere, some go into other jobs, some leave the labor force. Given that each group is motivated differently, separate models would have to be developed. This makes larger sample sizes for the entering teacher sample important.

Another desirable design feature is to follow longitudinally a sample of teachers who do not leave. This sample—when matched with the attrition sample—can provide an important set of variables for studying the role of salary in teacher attrition decisions. Do those who leave earn more in salary and benefits than those who stay? It is only by following individual teachers who leave or stay that we can answer this important question. If we find that salary and benefit levels are approximately the same for both groups, then the inference that other factors drive individuals from the profession is stronger.

A longitudinal sample of continuing teachers would also allow us to monitor changes at the individual level in key variables in the teaching profession: for instance, salary and promotion progression, changes in courses and levels taught, satisfaction indexes, marital status and family changes, and so on. This dynamic aspect of teacher characterization can provide a better predictive base from which to understand individual decisions to leave teaching, to change schools, to change districts, and to continue teaching.

Building improved state models and fielding national teacher surveys are complementary activities that can yield better supply/demand estimates. A national survey of teachers would collect key data on attrition rates, reserve pool entrance, and other data that will supplement state data. For instance, many states do not collect data on where their teachers come from. The national data will contain excellent data on sources of teachers, and analysis of these data could explain why different regions have different sources of teachers. Adequate estimates could then be made for states on sources of teachers. Analysis of national data might also discover some of the key nonpecuniary determinants of attrition rates for teachers and could be used to improve state models.

Because state data have large sample sizes and time-series components, whereas national survey data will have a richer set of variables and will support a wider set of attrition definitions, the two data sources will be complementary. Using both sources will result in better attrition estimates than using either source alone.

The Need for Time-Series Data on Attrition

We have shown above that there are a number of reasons to believe that teacher attrition rates are not static and thus times-series data on attrition become crucial. Several factors that make attrition rates dynamic can be modeled if time-series data are available.

First, the age composition of the teaching force changes over time; hence, the proportion of the force nearing retirement also changes. In addition, recent data from a number of states and school districts suggest that attrition rates are especially high (50 percent or higher) for inexperienced teachers during their first few years. Thus, the experience composition of the teaching force—also related to the age distribution—may be an important (and changing) variable. Third, labor market forces in teaching and in the general economy undoubtedly influence turnover. When teaching positions are scarce, temporary exits may be fewer because of expected difficulty in re-entering; when other opportunities are plentiful, career changes are more likely. (These opportunities may also, of course, be more plentiful in some regions of the country and for teachers in certain fields—especially math, science, and computer science—than others.)

Finally, policy variables may influence attrition rates. Incentives for early retirement, for example, became widespread in school districts during the 1970s, when declining enrollments required reductions in force. These incentives may now work, ironically, to produce shortages. Current policy initiatives, such as internships for beginning teachers and merit pay or career ladders for veterans, are also intended to influence attrition rates.

Suffice it to say that we should expect attrition to change with the shape of the teaching force, with the health of other sectors of the economy, and with changes in policy affecting teachers. We ought, then, to be prepared to estimate attrition rates regularly for various classes of teachers as a basis for preparing and modifying projections of demand.

The volatility of attrition rates means that projections should ideally be based on time-series as well as cross-sectional data. No time-series data exist at the national level (with the possible exception of the Social Security number file) on teacher attrition. However, several states do have data from which accurate time-series data could be constructed. One major limitation of the state data is that one can generally identify the different types of attrition (involuntary compared with voluntary), but only if a teacher left teaching within the state. Another limitation is that time-series data may be dominated in certain states by reductions in force during the late 1970s or early 1980s. If teachers who are laid off cannot be identified, then accurate projections from these data may not be possible.

Careful analysis of data from several states could probably show the important determinants of attrition and the magnitude of interstate differences and could provide some parameter estimates that could improve national projections. If so, such an effort might be worth the substantial research and processing costs of analyzing data from several states.

An important extension in this area would be to perform survival analyses of cohorts of teachers over time, that is, to follow samples of teachers from their point of entry into the profession over time to investigate more fully the causes of attrition. This is an alternative research strategy that needs to be incorporated because of its importance in highlighting the policy implications of other research findings. Developing attrition estimates for supply/demand models from cross-sectional data or even from time-series data by merely disaggregating across various subgroups of teachers may potentially lead to some erroneous policy implications. Survivor analyses and multivariate models are necessary to understand how different factors affect attrition and returns to teaching, and how these effects change over time. Both these research strategies are complementary, not exclusive.

SUMMARY: DATA REQUIREMENTS

Our understanding of teacher attrition can be markedly improved in several ways. They include the following:

- Selective centralization and analysis of historical state teacher personnel and certification files.
- Initiation of a national teacher survey with longitudinal elements that has a sampling and stratification plan sensitive to attrition measurement and analysis, including

  - A large sample of entering teachers who are longitudinally followed.
  - A sample of both leaving and staying teachers who are followed.
- Encouragement of better designed and more widespread state surveys of teacher personnel which can be linked to state personnel files.
- Selective use of Census and Social Security files containing data on teachers.

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